ANNALS

OF

SURGERY

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A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE.

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ANNALS OF SURGERY.

PERFORATING ULCER OF THE STOMACH.[1]

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Recent medical literature abounds in discussions of the various aspects of the subject of perforating ulcer of the stomach. Among the best articles that have appeared, and which have been carefully studied and extensively made use of in the preparation of this paper, are those by Mikulicz, Lennander, Heinecke, Lindner, and Leube; Gould, Barker, Bidwell, and Mitchell; and in this country Welch, Wier, and Foote; Richardson, Lund, Keen, and Tinker. Many others have done good work in this field, and any paper prepared to-day can but retraverse the ground already so well covered.

History.—In 1880, Mikulicz, while still Billroth's assistant in Vienna, closed by suture a perforation on the lesser curvature of the stomach. The patient died in collapse three hours after the operation. It was not until twelve years later that a successful case, operated upon by Heusner, was reported by Kriege. The first American surgeon to operate upon this condition was Wier in 1891, and the first successful case is reported by Atherton in 1894. From 1880, the date of Mikulicz's first case, up to 1896 but seventy-eight cases were reported.

Tinker, in a very able article upon the subject, reports 232 cases operated on up to 1900; and we are able to add thirty-

[1] Read before the American Surgical Association, May 1, 1900.

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six additional cases, making a total of 268 up to the present time. Of these thirty-six cases, fifteen are taken from Lund's recent tables (Nos. 6, 14, 27, 50, 51, 52, 55, 56, 94, 95, 96; Tables Nos. 2, 15, 32, 34, 40), which are not included in Tinker's list. The other twenty-one are taken from current literature. The results in the 268 cases are: Recoveries 139, deaths 129; a mortality of 48 per cent.; and in the twenty-one most recent cases, thirteen recoveries and eight deaths: a mortality of 38 per cent.

Etiology.—The etiology of perforation is not thoroughly understood. That certain factors are frequently concerned in the production of perforation is admitted, *e.g.*, traumatism, muscular efforts, distention of the stomach with rough and irritating food or drink, etc. Most frequently, however, there is no known determining cause.

Frequency of Occurrence of Perforation.—Perforation is a relatively infrequent sequel of gastric ulcer, occurring in from 6.5 per cent. to 18 per cent. of all cases, according to various statistics. It varies much in different countries and in different localities. Of Tinker's 232 cases, but twenty-two occurred in the United States. Thirty-five cases of gastric ulcer have been treated as such in the wards of the Johns Hopkins Hospital. Perforation has occurred in but a single instance. In this case operation was undertaken by Dr. Bloodgood, but, owing to the desperate condition of the patient, could not be completed.

Perforation takes place relatively more frequently in men than in women, but actually five times more frequently in women; and in the vast majority of cases it occurs in persons in the lower walks of life, particularly young servant girls. It has been observed to be more common in women before the age of thirty, and in men after forty.

Pathological Anatomy.—The fact of greatest surgical importance in the pathological anatomy of perforating gastric ulcer is the presence or absence of adhesions. By their presence and strength they stay the inflammatory process and largely determine its limitations, making possible spontaneous

healing, and rendering the exercise of surgical art less urgent and more efficient. Their absence allows the unobstructed progress of the septic elements to the remotest boundaries of the peritoneum. By their agency, largely, localized abscess formation is brought about, or the development of a general peritonitis delayed.

The location of the perforation in the stomach wall determines whether the substance of the pancreas, liver, or spleen will be primarily involved in the inflammatory process. Later, through softening and extension of this process, adjacent structures, as the diaphragm, pleura, pericardium, and abdominal wall, may become involved and perforated, and the pus be discharged into the hollow viscera, transverse colon, duodenum, gall-bladder, heart, lungs, or upon the surface of the body. Fistulæ into these organs are, however, rare; but subphrenic abscess itself is not uncommon, having its origin in a perforated gastric or duodenal ulcer in 20 per cent. of all cases.

If there are no limiting adhesions between the base of the perforating ulcer and the neighboring organs, there is nothing to prevent the extravasation of gastric contents, with the rapid development of a peritonitis, the nature and extent of which are determined by several factors:

(1) *The Site of Perforation.*—From the anatomical relations of the stomach walls and the surrounding structures, it is evident that protecting adhesions are more likely to take place in the case of ulcer on the posterior than on the anterior wall. According to Paris . and Lindner, of 200 cases of gastric ulcer, 190 will be on the posterior wall and ten on the anterior wall; of the 190, four will perforate: of the ten, eight and a half will perforate. While ulcer in general is much more frequent near the pylorus than the cardia, cardiac perforation is relatively about twice as common. Both ulcer and perforation occur more frequently upon the lesser than upon the greater curvature.

(2) Statistics show that in about 20 per cent. of cases there is more than one perforation; there may be several; in rare cases many.

(3) The size of the perforation or perforations is of great importance in determining the amount and rapidity of the extravasation of the gastric contents.

(4) The severity of the resulting peritonitis is influenced largely by the character and amount of the gastric contents. There is always the escape of more or less air from the stomach into the peritoneal cavity; but this is of small moment compared with particles of digested or undigested food in greater or less amount, the marked influence of which solid particles in the production of peritonitis has been known since the work of Grawitz, Halsted, and others. If the perforation occurs while the stomach is empty, the inflammatory process is, as a rule, less intense, and the chances of a favorable outcome are greatly enhanced. The point of greatest intensity of the inflammation is, at first, in the neighborhood of the perforation, and it is here, also, that the recent adhesions form, when present. It is well to bear these two facts in mind while opening the abdomen, since they act as efficient guides to the location of the ulcer.

(5) Of course the main factor in the production of the resulting peritonitis is the number and varieties of bacteria that escape from the stomach into the peritoneal cavity at the time of perforation. The species of bacteria found in the stomach depend, in turn, somewhat upon the nature of the food ingested, but in the stomach, as in the intestine, the flora is more or less constant.

To confine ourselves more particularly to the pyogenic bacteria, with which alone we are now concerned, it is probable, from the observations of Alapy, Hamburger, Kitasato, Macfadyen, Gillespie, and others, that there is no pyogenic organism that may not, under certain circumstances, be present and remain active for some time in the human stomach. They have been found at the height of digestion, and in perfectly empty stomachs. And recent investigations go to show that the stomach is incapable of completely sterilizing itself; that its mucosa is never germ free. The bacilli of tetanus, typhoid fever, and green pus, the colon bacillus and the pyogenic cocci

are some of the forms that have been repeatedly found in the healthy stomach. Cushing was able to recover from the jejunal fistula of a patient in the Johns Hopkins Hospital pathogenic bacteria still active, which had been taken into the mouth in inoculated milk. He also demonstrated that "the ingestion of a sterilized diet—the mouth meanwhile being rendered as clean as possible by frequent antiseptic washes—was followed by a pronounced diminution in the number of colonies on plates inoculated from the lumen of the proximal bowel. For forty-eight hours before the operation every precaution was taken to prevent the entrance of micro-organisms through the mouth, and at the time of operation, cultures taken from that part of the bowel above the fistula, where a partial resection was rendered necessary, remained sterile, and no organisms could be demonstrated on stained preparations from the mucosa."

Operators have been singularly remiss in noting the kind of bacteria found in the peritoneal exudate, and but few observations have been recorded in the published cases,—too few to be of any statistical value. The knowledge of the nature of the infectious agent with which we are dealing, from the stand-point of prognosis, is of great importance.

The writers just named have studied carefully the effect of the acid gastric juice upon many varieties of bacteria; and while it is true that many organisms which enter the stomach with the food perish there from its action upon them, still, there are many others that successfully resist, and even remain for a longer or shorter period in the deeper layers of the mucosa after the food has passed out, ready to exert their baleful influence whenever a perforation affords them the opportunity. It is probable that the varying acidity of the gastric fluids in diseased conditions, such as are present in the case of ulcer,—although frequently a hyperacidity is noted in such conditions,—may on the whole rather favor than retard the development of bacteria.

Symptomatology.—That there are no distinctive symptoms indicative of an impending perforation seems assured.

The occurrence of perforation itself, however, is attended, as a rule, by certain well marked phenomena. The most constant and characteristic symptom, perhaps, is sudden, sharp, intense pain in the upper half of the abdomen. This pain, from the intimate relation of the sympathetic nerves with the seventh, eighth, and ninth spinal roots, frequently radiates to the left shoulder. It is accompanied often by vomiting and more or less pronounced symptoms of shock, such as blanched skin, sweating, weak and rapid pulse, shallow respiration, etc. Localized tenderness, gradually extending over the upper part of the abdomen, and marked rigidity, with retraction, of the abdominal muscles, are early noted. Later the retraction of the abdomen gives way to an increasing distention, and hepatic and splenic dulness may disappear. If there has been an escape of any considerable quantity of fluid into the abdominal cavity, fluctuation and movable dulness may be detected. Vomiting is inconstant, appearing in about 40 per cent. of all cases; the vomitus consists usually of the stomach contents and rarely contains blood; as a rule, it occurs but once or twice and then ceases. Peritoneal friction rub, which has been described, is rarely observed.

Another important symptom, to which, hitherto, no attention has been paid in this disease, is the leucocyte count. I first called attention to this point several years ago, in connection with the diagnosis of intestinal perforation in typhoid fever, and what was said in that connection applies with equal force here.

Richard Cabot says "leucocytosis is practically never seen in the course of gastric ulcer except after severe hæmorrhage and at the height of digestion. When patients who have been fed for some time by the rectum alone are first given food by the mouth, the digestion leucocytosis may be marked; in one case it was observed to rise from 4000 to 15,000. After severe hæmorrhage the leucocytosis is only relative, but develops very rapidly. The presence of a leucocytosis, when the influence of bleeding and digestion is excluded, is practically unknown" in uncomplicated gastric ulcer. When, therefore,

any or all of the above-mentioned symptoms occur in a young woman giving a history of previous digestive disturbance, however slight, together with the sudden development of a marked leucocytosis, the indications for immediate surgical interference are imperative. The real significance of the sudden changes in the number of leucocytes in conditions such as this is as yet unknown; but that it is a diagnostic sign of considerable importance in many cases cannot be questioned; too much reliance, however, should not be placed upon it, as at times it has been wanting, at least at the time of observation.

Diagnosis.—The diagnosis is based upon a previous history of dyspeptic troubles, which history is obtainable in 92 per cent. of all cases; hæmatemesis, etc.; sudden pain in the upper portion of the abdomen, followed quickly by the development of more or less well-marked signs of peritonitis. The condition is to be differentiated from ulcer of duodenum, visceral colics, appendicitis, acute dilatation of the stomach, hæmorrhagic pancreatitis, acute poisonings, uræmia, cancer, intestinal obstruction, pelvic hæmatocele, and cholecystitis. The history of the case will aid largely in making the diagnosis. In the intestinal obstructions the individual coils and peristaltic movements are usually visible and palpable, and borborygmi audible.

Treatment.—The treatment is entirely surgical, for recoveries under an expectant treatment are of the greatest rarity, estimated at 5 per cent. Pariser has collected fourteen and Hall six cases of apparent perforation with recovery, but the diagnosis must be, in such cases, always in doubt.

Surgical Treatment.—If surgical interference has been long delayed, and the infectious process has not been walled off by adhesions, the question then resolves itself into the treatment of a general septic peritonitis, and the same principles that apply to the treatment of this condition elsewhere apply here. Among the first questions that press for answer are,—

(1) Shall we give opium or not? If sure of our diagnosis, we may allow a limited amount of opium, in order to alleviate the suffering of the patient while preparing for the

operation. The general rule holds good in all such cases, however, that the less opium administered, the better the prognosis. I can recall many instances, in my own experience, where the prognosis has been markedly influenced for the worse by the free administration of opium by the attending physician.

(2) Shall we wait until the shock is recovered from? The answer to this question must be in the negative. If the collapse of the patient is so extreme that she is practically moribund, of course no operative procedure would be justifiable; but under ordinary circumstances the sooner the operation is undertaken the sooner the cause for the shock will be removed, and the stimulation of the anæsthetic has often a beneficial effect.

(3) What are the indications for operation? The classical picture as described above, which can be recognized by any one, of course constitutes a definite indication, but in the other less classical, and perhaps more frequently observed, cases, where the symptoms present are urgent and progressively becoming more pronounced, and where there is reason to believe that there is some severe abdominal lesion, it is not certain what, an exploratory incision should be made early, in order to establish a diagnosis. In other words, one should not, in urgent cases, wait for a diagnosis, and thus lose the golden opportunity to relieve the patient, but should operate in order to make a diagnosis. And here we cannot emphasize too strongly the value of cocaine anæsthesia for this purpose. It is strange that this method, which has been used for years in some of the German clinics, notably Mikulicz and Kocher, has gained so little headway in this country. I first suggested its advisability several years ago in exploratory incisions in doubtful cases of typhoid perforation, and have had opportunity to test its value in this as in other conditions. It can be carried out in practically every case, and in very weak patients, with little or no disturbance of the patient, either local or general, and has the additional value of not being followed by post-

anæsthetic sequelæ, as occasionally happens after ether or chloroform.

An incision should be made in the middle line, between the ensiform cartilage and umbilicus, under cocaine or Schleich solution anæsthesia, sufficiently large at first to allow inspection of the interior of the peritoneal cavity and its contents. Through this opening cover-slips and cultures can be taken from the peritoneal fluids for immediate and future examination. If no indication for further operative procedure is found, the exploratory wound can be immediately closed, and no harm has been done and the condition of the patient little, if any, disturbed. If, however, it is found that a peritonitis is present, or an extravasation of gastric contents has taken place, the incision can be immediately enlarged. If the patient complains much, the cocaine may be supplemented by a few whiffs of ether or chloroform. In some instances the operation can be completed under cocaine anæsthesia alone.

As soon as the abdomen is opened, a rapid, systematic, and thorough examination of the stomach should be made. Beginning with the cardiac end, which is more frequently found to be the seat of perforation than the pylorus, one should go carefully over the anterior wall of the stomach to the pylorus, then the lesser curvature, which is more frequently involved than the greater curvature, and, lastly, lift up the stomach and examine the posterior wall. By following this method in the search, examining in order the most likely seats of perforation, one may save much valuable time. Nor should one stop when one has found a single perforation, as in 20 per cent. of cases two or more perforations are found to exist. One can frequently examine fairly well the lesser peritoneal cavity without opening into it, but one should not hesitate to do this in case of doubt. The stomach wall may vary greatly in thickness and consistency. At times, from pyloric obstruction, it may be so hypertrophied and indurated as to be mistaken for carcinoma, as occurred in one of my own cases. If the perforation is very difficult of access, or cannot be found at all, or is surrounded by firm protecting adhesions, it is best to cleanse the

peritoneal cavity as thoroughly as possible and drain, either by tube in the ulcer itself, packed about by gauze, or by gauze alone. It is a good rule not to recklessly disturb adhesions which have walled off the general peritoneal cavity, but rather to preserve them. If the perforation is accessible and the stomach walls will permit of suture, the hole should be closed by, preferably, a double row of sutures. The mattress suture of Halsted has, we think, distinct advantages over others. It is unnecessary to excise the ulcer, but where hæmorrhage has been frequent and the patient's condition admits of it, it might be advisable. Where, however, owing to infiltration and stiffness, or great friability of the stomach wall, it is found impossible to suture, one can drain with gauze or tube, as in the case of inaccessible ulcers; or one can plug the opening with a roll of omentum or suture a coil of intestine over the opening, successful instances of which have been reported. It has been recommended, in the case of inaccessible ulcers on the posterior wall, to incise the anterior wall sufficiently to allow access to the perforation. The conditions justifying the use of such procedure, however, will seldom arise. Care should be exercised in suturing ulcers in the neighborhood of either orifice, that no stricture or kink results. This is best avoided by making the line of suture at right angles to the long axis of the stomach.

As to the treatment of general septic peritonitis which is frequently present, if the operation has been delayed, the method of procedure which we advised several years ago in the management of peritonitis following perforating typhoid ulcer we have found most satisfactory.

The steps of the operation are as follows. One or more incisions, free enough to allow an examination of the entire peritoneal cavity, should be made. Through this the intestinal coils are to be withdrawn sufficiently to allow the operator to evacuate any peritoneal exudate, and thoroughly cleanse, with warm salt solution and gauze pledgets, all recesses and folds. The intestinal coils, which should be kept covered, by an assistant, with warm salt sponges or towels during this

manœuvre, should then be cleansed as far as possible from exudate and lymph, by irrigation and wiping with pledgets of gauze, and replaced in the abdominal cavity. Too much time should not be consumed in the cleansing, nor should the intestines be handled roughly, thereby producing a certain amount of shock; but it is difficult to exercise too much care in the peritoneal toilet.

The pelvis should never be overlooked, and it may be necessary to make a second incision low down in order to drain it properly. Strips of bismuth or iodoform gauze can be introduced into the pelvis, or about the suture, or in the most dependent portions of the peritoneal cavity for drainage. If the operation has been performed early after the perforation, and the suture has been accomplished satisfactorily, and the peritoneal cavity thoroughly and conscientiously cleansed, we believe it will not be found necessary always to drain by other than the postural method, as suggested by Clarke, particularly if there has not been much extravasation of stomach contents, and if the cover-slips show the absence of streptococci. In case of doubt, however, it is better to drain. If the operation has been performed late, and the bowels are much distended, the injection at the time of operation into the lumen of the intestine of salts, as suggested by McCosh, is advisable, or perhaps the temporary establishment of a jejunal fistula in order to relieve the paralyzed bowel.

For post-operative distention, which will always be more marked in cases where opium has been used freely before operation, calomel in broken doses, followed by salts, high enemata of glycerin and water or glycerin and oil, or turpentine, are to be recommended. The careful washing out of the stomach, while it is only to be used in extreme cases of persisting nausea, may give great relief. The application of the Paquelin cautery to the abdomen is also of advantage.

The patient should be kept upon rectal feeding absolutely for several days, then water or egg albumen in small amounts may be cautiously allowed.

Some of the complications which have been noted are

intestinal obstruction from kinking, parotitis, phlebitis, subphrenic abscess, pneumonia, and empyema. These conditions are to be dealt with as the occasion requires. In case, however, of the subsequent development of intestinal obstruction, no delay should be permitted in reopening the abdomen and relieving the obstruction. The contraindication to subsequent operations of this sort is no greater here than in the case of typhoid perforation, where it has been successfully accomplished.

Prognosis.—The prognosis depends largely upon several factors:

(1) The condition of the stomach, whether empty or full, when the perforation takes place.

(2) The interval between the last meal and the perforation.

(3) The time elapsing between the perforation and the operation.

(4) The number and size of perforations.

(5) The position of the patient at the time of perforation.

(6) The perfection of the technique at the operation.

(7) The nature of the infectious agent, whether streptococcus pyogenes or not.

It is probable, as Richardson has pointed out in a recent paper, that the size of the perforation, permitting of a rapid escape of a large amount of stomach contents, is as much a factor in the development of the rapid fulminating forms of peritonitis as the character of the organism itself; as he expresses it, "a sudden overwhelming of the abdominal cavity rather than a spreading invasion."

In the cases reported by Pariser and Hall, in which recovery without operation has taken place after supposed perforation, the perforation invariably occurred in an empty stomach. It has been urged by some that the position of the patient, whether sitting or erect, or in the horizontal position, exercised considerable effect upon the amount of extravasation at the moment of perforation. A study of the fatal cases

shows that the cause of death in the majority of instances was sepsis, either from the subsequent development of a local subphrenic abscess or from the immediate results of the peritonitis, so that too much stress cannot be laid upon the care and detail with which this part of the operation is carried out. A study of the successful cases brings out the fact that in a considerable proportion of them, particularly in those cases operated upon late, there developed, subsequent to the suture, a certain amount of suppuration either in the abdominal wall or in the deeper tissues. This has not seemed, however, to affect materially the ultimate result. While, on the other hand, of those cases operated upon early, before twelve hours, Tinker particularly emphasizes the fact that, in the past three years, 83.78 per cent. have recovered. Granted that this percentage may be, perhaps, too high, it is still most encouraging in its great and continuous increase over the doubtful 5 per cent. that recover without surgical aid.

TABLE OF CASES OF PERFORATING ULCER OF THE STOMACH SUBMITTED TO OPERATION NOT INCLUDED IN THE TABLES OF PREVIOUS WRITERS.

No. 1.—*Operator,* Mitchell. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Male, aged twenty-five years. *Site of perforation,* anterior surface of pylorus. *Time,* sixty hours. *Result,* died in twenty-four hours. *Remarks,* irrigation; second ulcer near cardia.

No. 2.—*Operator,* Mitchell. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged twenty-eight years. *Site of perforation,* anterior surface near lesser curvature. *Time,* four hours. *Result,* died in eighteen hours. *Remarks,* partial excision; irrigation.

No. 3.—*Operator,* Browne (Walter). *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged nineteen years. *Site of perforation,* anterior surface near cardia. *Time,* three hours. *Result,* recovered. *Remarks,* irrigation; drainage; abscess of anterior wall; No. 6 of Tinker's list.

No. 4.—*Operator,* Mitchell. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged twenty-one years. *Site of perforation,* anterior surface near lesser curvature and near cardia. *Time,* twenty-four hours. *Result,* died in twenty-eight hours. *Remarks,* irrigation; drained.

No. 5.—*Operator,* Sinclair. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Male, aged forty-five years. *Site of per-*

foration, anterior surface near pylorus. *Time,* three and one-half hours. *Result,* died in twelve hours.

No. 6.—*Operator,* Wheeler. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Male, aged forty years. *Site of perforation,* anterior surface near lesser curvature. *Time,* eighteen hours. *Result,* died on tenth day. *Remarks,* douched; drained; death from intestinal obstruction due to adhesion.

No. 7.—*Operator,* Sinclair. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged nineteen years. *Site of perforation,* anterior surface near cardia. *Time,* twenty-seven hours. *Result,* recovered. *Remarks,* sponged; drained.

No. 8.—*Operator,* Mitchell. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged thirty-two years. *Site of perforation,* anterior surface near lesser curvature and three inches from pylorus. *Time,* eight and one-half hours. *Result,* recovered. *Remarks,* sponged; drained.

No. 9.—*Operator,* Campbell (Robert). *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Male, aged thirty years. *Site of perforation,* anterior surface close to pylorus near lesser curvature. *Time,* twenty-six and one-half hours. *Result,* died. *Remarks,* douched with boiled water; drained.

No. 10.—*Operator,* Campbell (John). *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged thirty-two years. *Site of perforation,* anterior surface close to lesser curvature and midway between pylorus and cardia. *Time,* six and one-half hours. *Result,* recovered. *Remarks,* sponged; douched; drained.

No. 11.—*Operator,* Mitchell. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged twenty-two years. *Site of perforation,* anterior surface near lesser curvature and cardia. *Time,* eight hours. *Result,* recovered. *Remarks,* sponged; drained.

No. 12.—*Operator,* Sinclair. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Male, aged twenty-seven years. *Site of perforation,* anterior surface near lesser curvature and two-thirds of an inch from cardia. *Time,* eleven and one-half hours. *Result,* died on twenty-second day. *Remarks,* sponged; douched; drained; at autopsy right and left subphrenic abscess; left pleural abscess; pericarditis.

No. 13.—*Operator,* Mitchell. *Reference,* British Medical Journal, March 10, 1900, Vol. i, p. 568. Female, aged twenty years. *Site of perforation,* anterior surface near pylorus. *Time,* five hours. *Result,* recovered. *Remarks,* sutured; sponged; drained.

No. 14.—*Operator,* Griffiths. *Reference,* British Medical Journal, 1900, Vol. i, p. 573. Male, aged nineteen years. *Site of perforation,* anterior wall close to pylorus. *Time,* twelve hours (?). *Result,* recovered. *Remarks,* irrigated; sponged; closed.

No. 15.—*Operator,* Griffiths. *Reference,* British Medical Journal, 1900, Vol. i, p. 573. Male, aged twenty-seven years. *Site of perforation,* anterior wall near pylorus. *Time,* twenty-four hours. *Result,* recovered. *Remarks,* tuck of stomach to close perforation; douched; closed.

No. 16.—*Operator*, McCosh. *Reference*, Medical News, May, 1896, Vol. lxviii, p. 486. Female, aged thirty years. *Site of perforation*, lesser curvature. *Result*, recovered. *Remarks*, sutured opening; good recovery; slowly increasing epigastric pain for five or six weeks before operation.

No. 17.—*Operator*, Eve. *Reference*, London Lancet, January 25, 1900, Vol. i, p. 155. Female, aged thirty-eight years. *Site of perforation*, posterior wall near lesser curvature one and a half to two inches from cardia. *Time*, eight hours. *Result*, recovered. *Remarks*, abdomen washed out and drained; healed by first intention.

No. 18.—*Operator*, Robson. *Reference*, British Medical Journal, March 10, 1900, Vol. i, p. 674. Female. *Result*, recovered. *Remarks*, abdomen cleansed and closed; good recovery.

No. 19.—*Operator*, Huntingdon. *Reference*, ANNALS OF SURGERY, April, 1900, p. 458. Male, aged forty-two years. *Site of perforation*, anterior wall two inches from pylorus. *Time*, fourteen hours. *Result*, recovered. *Remarks*, operated first for appendicitis; removed appendix, then irrigated and sutured.

No. 20.—*Operator*, Richardson. *Reference*, Philadelphia Medical Journal, February 3, 1900, Vol. i, p. 272. Male, aged twenty-two years. *Site of perforation*, anterior wall three inches from pylorus. *Time*, (?). *Result*, recovered. *Remarks*, sponged; irrigated; drained.

No. 21.—*Operator*, Richardson. *Reference*, Philadelphia Medical Journal, February 3, 1900, Vol. i, p. 272. Female, aged twenty-seven years. *Site of perforation*, anterior wall at junction of upper and middle third of transverse and longitudinal axes. *Time*, forty-eight hours. *Result*, died on eleventh day. *Remarks*, irrigated; drainage-tube in stomach; death from second ulcer on posterior wall.

REFERENCES TO PAPERS CONSULTED.

Alapy: Wiener med. Wochenschr., 1890, Nos. 1, 2, and 3.

Bidwell: Am. Journ. Med. Sciences, September, 1899.

Clark: Johns Hopkins Bulletin, No. 73, 1897.

Cushing: Johns Hopkins Hospital Bulletin, No. 100, July, 1899.

Finney: ANNALS OF SURGERY, March, 1897.

Gillespie: The Journal of Pathology and Bacteriology, Vol. i, p. 279.

Hall: Brit. Med. Journ., January 9, 1892.

Hamburger: "Inaugural Dissertation," Breslau, 1890.

Heinecke: Pentzoldt and Stintzing, Handb. d. Therap. Inner. Krankh., Jena, 1898.

Keen: Phila. Med. Journ., June 4, 1898.

Kitasato: Zeit. f. Hygiene, Band iii.

Kunloff and Wagner: Cent. f. Bakt., 1890, Band viii, No. 14.

Lenlee: Archiv f. klin. Chir., Band lv.

Lennander: Mittheilung u. d. Grenzgeb. der Medicin u. Chirurg., Band iv, 1899.

Lindner and Kuttner: Chirurg. des Magens., Berlin, 1898.

Lund: Boston Med. and Surg. Journ., January 11, 1900.

Macfadyen: Journ. Anat. and Physiol., Vol. xxi, Part II, 1887.
Mikulicz: Archiv f. klin. Chir., Band lv.
Mitchell: British Med. Journ., March 10, 1900.
Pariser: Deutsche med. Wochenschr., 1895, 28 and 29.
Richardson: Phila. Med. Journ., February 3, 1900.
Robson: The Lancet, March 10, 1900.
Satterthwaite: New York Med. Record, March 24, 1900.
Tinker: Phila. Med. Journ., February 3, 1900.
Wier: Med. News, April 25, 1896.
Wier and Foote: Med. News, Nos. 17 and 18, 1896.

BENIGN OBSTRUCTION OF THE PYLORUS.[1]

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Congenital Obstruction.

Benign obstruction of the pylorus may either be congenital or acquired. Of the congenital variety, we may distinguish two forms,—one which presents itself as a complete closure of the first part of the duodenum and pylorus, the intestinal tract at this point being either converted into a fibrous band, or showing a stenosis of very high degree, and another, generally at the outset, moderate narrowing, which is always situated at the pylorus, and becomes clinically apparent only after several months of life. The first variety is supposed to be the result of a fœtal peritonitis, of probably syphilitic origin, and generally causes death in a few days. The second, known as congenital hypertrophy, is generally ascribed to a hyperplasia of the inner circular muscular layer of the pylorus. Pfaundler, in a critical analysis of all cases reported, has lately questioned the correctness of this view, based on direct measurements of the thickness of the pyloric wall. He calls attention to the fact that a normal stomach, with contraction of the pylorus persisting after death, presents identically the same appearance as is found in so-called cases of congenital hypertrophy. The symptoms during life are due, according to Pfaundler, to gastro-intestinal disorders, so frequent in young infants. The appearance of the pylorus after death is

[1] Read before the American Surgical Association, May 2, 1900.

explained as a post-mortem condition. That this does not apply to every case, he himself admits, and quotes Finkelstein, in whose cases a distinct tumor was at times felt in the region of the pylorus during life. I have also found a recent case of Batten, who says "a firm transverse mass, in shape like the pylorus, could be felt. It was not always palpable, when no peristalsis was taking place." For certain cases, if not for all, we may therefore assume that hypertrophy, mainly of the circular, muscular layer, does exist, leaving the question undecided whether this is a congenital malformation (Meltzer), or the result of over-action due to deranged nervous mechanism (Thomson). I have found four gastro-enterostomies for congenital hypertrophy in the late literature of the subject, two of which have been successful, and one pyloroplasty, which also resulted in a cure.

Acquired Obstruction.

Fibrous Stenosis.—Of the acquired forms of obstruction, the most common is fibrous stenosis. The simple round ulcer, of the chronic variety, situated either at the pylorus or near the same, is the most frequent cause of such obstruction, either from cicatricial contraction or the formation of a false tumor, due to chronic infiltration. The latter is often diagnosed as cancer, even after laparotomy, and only appreciated at its real value when gastro-enterostomy leads to a permanent cure or resection insures a microscopical examination. Thayer reports such a case, in which, on the basis of a chronic ulcer, a tumor formed which was due to fibrous thickening about an ulcer, and a great muscular hypertrophy of the pylorus. Another case is described by Hirsch in 1896. A tumor, the size of a plum, could be distinctly felt to the left of the median line. The symptoms of pyloric stenosis were present. At the operation, the tumor was found very near the cardia, drawn there by adhesions to the lesser curvature. The patient was well, and had gained considerably in a year. Lindstrom describes a similar case. About a year ago, I performed posterior gastro-enterostomy on a woman of twenty-six years,

with a well-defined and movable tumor of the pylorus as large as an egg. At a second laparotomy, five weeks later, no trace of the tumor could be found. These are not isolated cases.

Traumatic ulcers are much less frequently the cause of fibrous stenosis. They are either the result of contusion in the epigastric region or of ingestion of corrosive fluids. External violence leads to laceration, necrosis, and separation of the mucous membrane from the muscular coat of the stomach. But contusion does not always determine so severe a lesion. On the contrary, simple laceration of the mucosa may give rise to hæmatemesis, during the first few days after injury, and to nothing more. It has been demonstrated experimentally that wounds of the inner coat of the stomach have a great tendency to heal. Where stenosis of the pylorus follows external injury, we must assume that a considerable area of mucous membrane has become necrotic. Kroenlein has recently published two interesting cases,—in one, a man, of twenty-four, who was caught between the end of a wagon-pole and a wall, developed eight months later a very marked obstruction of the pylorus. In a second case, a man who was struck in the epigastric region with a pitchfork, while not materially disabled, presented himself three months later with the clinical picture of a severe stenosis. Swallowing of corrosive liquids is frequently followed by stenosis of the pylorus, with no serious lesions to the œsophagus or any parts of the stomach. Doyen was one of the first to point to the position of the normal stomach as the explanation of this phenomenon. He believes that the latter is always more or less vertical, the direction of the small curvature corresponding with that of the median line of the body. When the stomach is empty, the pylorus is its most dependent portion, lying a little to the right of the median line. As the stomach fills, the antrum pylori becomes distended, and the lowest part of the organ is now found at the large curvature. In support of this view, a case of Mikulicz may be mentioned, in which drinking acid after a meal was followed by an hour-glass contraction of the stomach, and not by stenosis of the pylorus. Hartmann,

four years ago, tabulated twenty-one cases of the traumatic variety of benign obstruction, seventeen of which were caused by the drinking of acids, two by the drinking of caustic alkalies, and one by the swallowing of chloride of zinc; in one case the agent is not named.

Acquired hypertrophic stenosis, although known to Cruveilhier, Andral, and others, was first accurately described by Lebert, some thirty years ago, who published a report of six of his own cases. The affection is due to a catarrhal condition of the stomach and consecutive proliferation of the muscular and connective tissues, especially at the pylorus. The disease seems to be one of early adult life, attacking individuals of from twenty to fifty years. Boas has lately published three cases, which were operated on by Hahn (gastro-enterostomy), all recovering and continuing perfectly well. In one of these cases the obstruction felt to the touch like the rubber ring of a beer-bottle. The clinical picture was that of stenosis of the pylorus of varying degree.

Obstruction of the Pylorus by Gall-stones is rather a rare form of stenosis. There are cases on record in which pressure of the adherent gall-bladder filled with stones caused obstruction; for simple evacuation of the stones was followed by the disappearance of all the symptoms (Mikulicz). In the majority of cases, adhesions having formed between the gall-bladder and the intestinal tract, more frequently the duodenum than the pylorus or stomach, perforation takes place, and the gall-stone passes into the intestine. It may here cause obstruction simply by its size. Stones as large as an egg have been found at the pylorus, but even smaller ones, not entirely filling the lumen of the bowel, have given rise to symptoms of complete obstruction by inducing a spasm of the pylorus or a thickening of its muscular coat, as the result of prolonged irritation (Bouveret). Gall-stones may leave the bile-ducts, become encysted in adhesions, and thus compress the pylorus or duodenum. Peritoneal bands and adhesions, the formation of which so frequently accompanies perforation of the biliary passages into the intestinal tract

will cause obstruction by compressing or kinking the region of the pylorus. Alex calls attention to the changes in the gall-bladder itself, when the latter has long been filled with stones, also to the contraction of the bowel at the seat of perforation; when the latter shows a tendency to cicatrize long after the gall-stones have passed by the rectum, or have escaped by way of the stomach during vomiting spells, the resulting contraction may lead to compression in the pyloric region.

The literature of this subject leaves no doubt, I think, of the fact that the mechanical conditions, which are the outcome of irritation and inflammation, are much more frequently the cause of pyloric obstruction than the gall-stones themselves. Tuffier and Marchais, in a recent article, expressed doubt as to the possibility of a gall-stone in the intestine ever being able to cause obstruction of itself; and Sokolowski related a case in which a huge gall-stone was caught in a fistulous opening between the gall-bladder and the stomach; yet the autopsy showed that complete occlusion was not due to its presence, but to the formation of bands and adhesions about the pylorus. The general consensus of opinion as to the causation of obstruction in these cases seems to be that in most of them all the factors enumerated are responsible, and that it is exceedingly difficult to name one of them as the only exciting cause.

Syphilitic Lesions of the Stomach are not uncommon. The tertiary forms alone interest us here, in the discussion of obstruction of the pylorus. Gummata situated at the pylorus, or along the lesser curvature, can obstruct the outlet of the stomach as such, or by ulceration lead to the formation of a cicatricial stenosis. Einhorn has very lately described two interesting cases of stenosis of the pylorus depending on syphilis. In one, an oval tumor first gave the impression of a cancer, but under specific treatment it disappeared entirely after several weeks. In the other, no tumor could be felt at the site of the pylorus; but the ineffectual general treatment which was continued for some time, with the improvement

which followed specific treatment, sufficiently support the diagnosis of syphilis. I have found another case of syphilitic stenosis of the pylorus, reported by Durante, which recovered after operation.

Benign Tumors of the Stomach are always mentioned in text-books as a cause of obstruction of the pylorus. Still, a survey of the literature upon this subject rather convinces me that such cases must be very rare. Large non-obstructing myomata, adenomata, polypi, and papillary growths have been reported, and even removed by operation. One of the earliest cases of obstruction was published by John Webster in 1827, who reported a tumor in a man of sixty-two: "A cartilaginous body intermixed with numerous spicula of bone, firmly attached by one extremity to the coat of the stomach, close to the pylorus, into which the other projected like a stopper, preventing passage into the small intestine." Betz, in 1884, observed a case of stenosis in a man of fifty-two, caused, as the autopsy showed, by a fold of mucous membrane, perhaps a polypus, two and one-half centimetres long, which was attached to the upper circumference of the pylorus. Mikulicz has seen a similar case. Andersen, Finnell, and Hutchinson have published cases of cysts in the wall of the stomach, all situated near the pylorus; but Hutchinson only speaks of the same in his case as large enough to completely occlude, as a valve, the pyloric opening. J. B. Stevens, 1896, has described a case which presented symptoms of obstruction. At the autopsy the stomach was found dilated and the pylorus thickened. A mass of soft pedunculated polypi sprang from the mucous membrane near the pylorus. It is probable that during the contractions of the stomach the polypi were forced into the opening of the pylorus, and thus acted as a valve. Pernice, in 1890, reports the case of a man of seventy-five who died of stenosis of the pylorus. At the autopsy a myoma was found, egg-shaped, six centimetres long and four centimetres broad, on the upper anterior wall of the stomach, near the pylorus, completely occluding the latter. Finally, Herhold, in 1898, relates the case of a woman of thirty-seven, with symptoms of

partial obstruction, in whom, at the operation, a tumor as large as a hazel-nut was excised from the pylorus. Pyloroplasty was added to the excision, and the patient made an excellent recovery. These are most of the cases of obstruction by benign tumor that I have been able to find.

Spasm of the pylorus may be intermittent or permanent. It is, as Doyen remarks, an exaggeration of physiological function. It is generally combined with hyperchlorhydria, and the relation of one to the other, the determination of cause and effect, has given rise to considerable discussion. Spasm of the pylorus is probably a reflex phenomenon, dependent upon some slight lesion of the mucous membrane at or near the pylorus; so small, indeed, as to escape detection after incision of the stomach wall. Or the reflex may be due to some general gastric disturbance. The trouble is regarded by others as a functional neurosis. The result of spasm is stasis and decomposition of the contents of the stomach. The presence of food in the normal stomach stimulates the secretion of hydrochloric acid, and, as this stimulation is increased by the presence of undigested and decomposed particles of food in stasis, a hypersecretion is the natural consequence. This hyperacidity, in turn, causes firmer contraction of the pylorus, thus establishing a vicious circle, which is only broken by the final relaxation of the pylorus and the increased action of the hypertrophic muscular coat of the stomach. That spasm of the pylorus is, in the first place, responsible for the clinical picture of hyperchlorhydria is well supported by the argument of Carle and Fantino, who have shown that hyperacidity disappears as soon as an operation has relieved the stasis. I have recently found an interesting case, published by Schnitzler, in which intermittent spasm of the pylorus was visible during operation. Even before the same, a tumor could at times be felt through the abdominal walls which, at other times, entirely disappeared. When the abdomen was opened, nothing was at first seen. But soon the pyloric portion of the stomach began to contract, forming a hard tumor, which disappeared and reappeared three times in a few minutes under

the eyes of the operator. It is well to remember that permanent spasm may lead to a chronic pyloritis and a genuine fibrous stenosis.

THE SURGICAL TREATMENT OF BENIGN OBSTRUCTION.

In the treatment of obstruction of the pylorus, we may either employ methods which aim to relieve the undue retention of food and secretions in the stomach, or such as deal directly with the seat of disease, in a mechanical way. Among the former, which should be employed in milder cases, are repeated daily washings of the stomach, the horizontal position after meals, a very restricted diet, and the use of Vichy or Carlsbad waters. Among the latter, we class all the operative procedures upon the pylorus itself, and gastro-enterostomy.

Dilatation of Stricture.—Ogston, in 1895, advised the ingestion of small gutta-percha spheres, beginning with a size smaller than the probable stricture of the pylorus, and gradually increasing its calibre to 40 French. Every five days one is to be taken after breakfast, the size of the spheres being very slowly increased. His results, in four cases, are not very encouraging. Hemmeter has constructed a tube which passes along the lesser curvature to the pylorus, but he recommends duodenal intubation in pyloric stenosis only as an aid to diagnosis, and not as a therapeutic agent. Kuhn, in two elaborate articles, describes spiral elastic sounds for dilatation in benign stenosis. Ulcers counterindicate their employment. Cases of moderate stenosis, Kuhn thinks, may be very favorably influenced by the introduction of these sounds. He further states that they glide along the large curvature of the stomach very readily, arching out towards the fundus. When the position of the stomach is rather vertical, the tip of the instrument will strike the large curvature nearer the pylorus, and the entire manipulation will become more simple. Kuhn does not prove his contentions by any clinical data, nor have I been able to find any cases of successful dilatation of the pylorus by way of the mouth.

Resection of the Pylorus.—Since Rydygier, in 1881, first

excised the pylorus for ulcer, this operation has been frequently done for non-malignant disease, *i.e.*, for the complications of ulcer with stenosis, or for either of these two conditions by itself. For all such cases combined, Haberkant, in 1894, computed a mortality of 34.4 per cent. Mikulicz, in a study of Billroth's, Czerny's, and his own cases operated on since 1891, has three years ago reduced the mortality to 27.8 per cent. In studying Heberkant's thirty-two cases of total resection of the pylorus just quoted, I find that seventeen were done for uncomplicated stenosis, with three deaths, *i.e.*, 18 per cent. These cases include cicatrices after simple and traumatic ulcers and one case of hypertrophy of the pylorus. It would seem from this that total resection, in cases of uncomplicated stenosis, is a safer procedure than total resection in cases complicated by ulcer. In looking over the publications of late years, it becomes apparent that total resection for benign obstruction is being entirely abandoned; its only indication being an open ulcer, with a suspicion of malignant degeneration. Stendel, for example, reports eight pylorectomies from Czerny's clinic, during 1895, 1896, and 1897, all for malignant disease, and none for benign stenosis.

Divulsion of the Pylorus.—Divulsion for stenosis has been practised by two methods,—the one, known as Loreta's, deals with the stricture after incision of the stomach wall from within; the other, Hahn's, seeks to accomplish the same object by invaginating the stomach wall into the lumen of the pylorus without incision, thus doing away with the risk of infection. It is not more than ten years since divulsion still had warm adherents, but now the method has met with the same fate as total resection. In the later statistics of prominent European surgeons, the operation does not figure any more. Nevertheless, individual cases are still described up to the present day, mostly by English surgeons. There we find the old story of frequent failures and a large mortality, which had been variously estimated in former years by Haberkant, Billroth, and others, at from 30 per cent. to 40 per cent. Cases most favorably influenced by divulsion are those of spasm of the pylorus, with hyperchlorhydria. Carle, in 1893 and 1894, operated

on two such cases by Hahn's method, which showed no recurrence after three or four years. The good results in these cases, and those observed after stretching of the sphincter ani for painful contraction, due so often to small fissures, are analogous. I have found recurrences after divulsion, after a lapse varying from five days to one and a half years; and still I have also found many reports of permanent cures after an observation of only several months in the literature of the past ten years. The reasons for the rejection of resection and divulsion in cases of benign obstruction are apparent.

Pyloroplasty has appeared on the scene, and the technique of gastro-enterostomy has been perfected in many ways. The mortality of both operations has been vastly reduced, and it has been shown that the remote results, both as regards the prevention of relapses and the restoration of normal gastric function, are, at least, as good as those after resection and divulsion.

Pyloroplasty and Gastro-Enterostomy.—The mortality of the two operations was found by Mikulicz and by Carle to be about equal. Mikulicz bases his calculations on the results of Czerny's, Billroth's, and his own clinic. If the statistics of some other surgeons who have operated on a number of cases be added, we get the following figures for operations in benign obstruction:

Operator.	Pyloroplasty.		Gastro-enterostomy.	
	Operations.	Deaths.	Operations.	Deaths.
Billroth, Czerny, Mikulicz	97	15	91	21
Doyen	3	2	32	4
Carle	14	1	26	1
Morrison	11	0		
Cavazzani	8	1		
Lentaigne, Page, Gould, Mills	7	2		
Selenkow	7	2		
Lange	3	0		
Carre	4	0		
	154	23	149	26

or a mortality for pyloroplasty of 15 per cent. and for gastro-enterostomy of 17.5 per cent. But these percentages do not represent the actual death-rate of to-day. The mortality of gastro-enterostomy has been much reduced, especially by those surgeons who have employed the Murphy button. Carle, in 1898, states that he has done twenty-three gastro-enterostomies during the past two years without a single death. Czerny says his mortality has been reduced 20 per cent. during the three years in which he has employed Murphy's button; and Kausch has only lately published twenty cases of pyloroplasty with one death and eleven gastro-enterostomies with no deaths. We may, therefore, safely assume that the mortality following gastro-enterostomy is not greater to-day than that following pyloroplasty, where, however, a like improvement is visible, owing to a more judicious selection of cases. Pyloroplasty has been frequently attempted, but has had to be abandoned on account of the presence of perigastric adhesions. In such an emergency, resection of the pylorus has occasionally been done, but when death has resulted from this procedure, it has not always been laid at the door of pyloroplasty, as should have been the case. Thus, Morrison a year or two ago published eleven consecutive cases of pyloroplasty, with no death; but he does not include two operations in this number in which, owing to extensive adhesions, resection was substituted in one and gastro-enterostomy in the other, both cases ending fatally. Such experiences have, no doubt, induced most surgeons to resort to gastro-enterostomy instead of pyloroplasty when adhesions are present. Adhesions may occasionally be the sole cause of obstruction, and many cases have been reported in which simple division has led to a permanent cure. I have in one case succeeded in entirely relieving a young woman of all her symptoms by this procedure. Obstruction of the pylorus was complicated, in her case, by severe jaundice; still, simple separation of extensive adhesions of the gall-bladder to the pylorus, and of both to the surrounding organs, caused the jaundice and obstruction to disappear, and have led to the re-establishment of perfect health for the past eight years.

Broad adhesions very likely form again after their separation, and, as the viscera will generally remain in contact with one another, such adhesions may become the cause of renewed obstruction. These cases, however, are few in comparison to those in which the trouble is primarily located in the pylorus, and gradually involves the peritoneal investment of the latter, forming adhesions with the adjacent organs. Cases of this latter kind call for additional surgical interference after separation of the adhesions; and if pyloroplasty is now added, the result must necessarily be very uncertain. Alex has called attention to the displacement of the pylorus in an upward, outward, and backward direction, and also to its fixation at a point most unfavorable for the evacuation of the stomach, following retraction of adhesions, due to cholelithiasis. The presence of extensive adhesions must, therefore, be regarded as a counterindication to the performance of pyloroplasty. Nor should pyloroplasty be attempted when much infiltration and thickening of the anterior wall of the stomach, in the neighborhood of the pylorus, exists, owing to the difficulty and uncertainty encountered in the application of sutures.

No such restrictions obtain in gastro-enterostomy for benign stenosis. I do not know of any case in which this operation has been attempted, and has had to be abandoned.

When pyloroplasty has been successfully done, the immediate result is generally good. The obstruction has been, for the time, at least, removed, and the stomach wall, having retained and perhaps increased its motor power, is fully able to expel the contents of the stomach through the enlarged outlet. After gastro-enterostomy the relation of the parts to one another is changed, and, as a result of this, certain disturbances may arise immediately after operation. The one most feared is regurgitation and vomiting. It is usually met with in malignant disease, and not so often when gastro-enterostomy has been done for benign obstruction. Regurgitation is ascribed to kinking and twisting, and especially to the formation of a spur at the site of the anastomosis. Much has been written about the latter. It seems to occur more frequently after an-

terior than after posterior gastro-enterostomy, and is due to the sharp bend in the intestine at the anastomosis and to the parallel position assumed by the legs of the intestinal loop after the former operation. The recumbent position of the patient during the first week or two after operation is another factor unfavorable to anterior gastro-enterostomy, as it necessarily retards evacuation of the stomach. The formation of a spur seems, furthermore, to occur more easily when broad peritoneal surfaces of the stomach and intestine have been united by sutures. Such, at least, has been my personal impression during the years in which I practised gastro-enterostomy with Senn's plates, Abbe's rings, but most frequently by making a large opening in the stomach and small intestine, and suturing with two rows of continuous sutures on each side. After application of the suture, one often notices the flat appearance of the small intestine at the site of the anastomosis, indicating that its mesenteric border is very near the opening itself. Many of these cases died from persistent regurgitation and vomiting, for which, at the time, I, as well as many others, could offer no explanation. If I contrast with this my experience of the past two years,—eleven posterior gastro-enterostomies, with Murphy's button, two for benign and nine for malignant obstruction,—the improvement in my results is very gratifying. In none of these cases have I observed the clinical symptoms of regurgitation. Two of them died,—one from pneumonia, and the other from simple exhaustion, the patient's condition hardly warranting any operative interference. In one patient the button passed on the twenty-eighth day, in three others it was never found, but caused no symptoms. My own more limited experience thus entirely agrees with that of Carle and Czerny, who also have never observed persistent vomiting since their adoption of the posterior operation with Murphy's button. Doyen does the posterior operation, but does not use the button. Mikulicz, who only shortly favored the button in gastro-enterostomy, has again abandoned its use, and has returned to the anterior operation. He had previously performed posterior gastro-enterostomy in forty-

three cases, but had frequently observed regurgitation. I venture to believe that the latter symptom was perhaps due to the employment of the suture, and might have been avoided if the button had been used, for Chlumsky, in reporting Mikulicz's cases, also speaks of the prevention of spur-formation by the use of the button. As Weir has only lately pointed out, it is this that we must seek to avoid, not so much the reflux of bile and pancreatic juice, which, according to all observers, takes place as well after anterior as after posterior gastro-enterostomy, and is not the cause of vomiting. But this is, I think, more readily accomplished by posterior gastro-enterostomy, on account of the easy apposition of the small intestine to the posterior wall of the stomach. I agree with Keen when he says that most all the modifications of gastro-enterostomy unnecessarily prolong the operation, and increase the danger of infection. Why should we recur to them, when gastro-enterostomy with the button accomplishes the same object with less risk? In the application of the button, I have always followed Carle and Fantino in the eleven cases above mentioned, substituting for the purse-string suture one or two simple sutures at each side of the cylinder of the button after the latter has been forced into the intestine through an incision as small as possible. Carle points out that the folds caused by tightening the purse-string suture are thus avoided, and the contact of the serous surfaces being perfect, better union takes place. Another advantage accrues, I think, from this procedure. When closed, the button is likely to exert more uniform pressure on all the constricted tissues than when a purse-string suture has been employed. The latter leads to an uneven puckering of the folds radiating from the cylinder. This is especially the case with the thick wall of the stomach. Thus, when the button is closed, some of the tissues caught between the constricting edges escape sufficient pressure to cause necrosis. I feel confident that the cases in which the button has remained *in situ* at the anastomosis are precisely such cases in which constriction was insufficient at some point. Of the fact, that the button frequently falls into the stomach instead of the jeju-

num, there can be no doubt. I have not found many cases in which this has caused trouble. Kocher mentions two in which he had to resort to gastrotomy for removal of the button, in one of which the latter was firmly caught at the pylorus, one and a half years after gastro-enterostomy. Hahn says the button may pass into the afferent loop of the jejunum and cause grave symptoms, or into the stomach, causing much pain and even hæmorrhage. In his statistics following this statement, I cannot find any such cases. The cases in which the retained button gives trouble must, therefore, be very rare. Another complication of gastro-enterostomy should be mentioned,—the constriction of the transverse colon by the attached loop, or *vice versa,* of the loop by the colon. We often read of it, but very little proof of its existence is forthcoming. Doyen gives an excellent illustration of compression of the colon by the attached jejunum after anterior gastro-enterostomy. But this was due to faulty technique, the point of attachment having been chosen too near the duodenum. Chlumsky, speaking of posterior gastro-enterostomy, says, "At Mikulicz's clinic I have observed a case in which the distended transverse colon compressed the legs of the loop attached to the stomach in such a manner that evacuation was impossible." One can conceive the possibility of such an occurrence in anterior gastro-enterostomy, where the loop of small intestine between its attachments to the spinal column and the stomach wall almost encircles the transverse colon. But it is difficult to imagine compression of either colon or jejunum in posterior gastro-enterostomy, where the relation of these parts to one another has scarcely been changed. This must be extremely rare, and is due, perhaps, to the formation of adhesions, an occasional unpleasant sequel of any laparotomy. I, therefore, believe that posterior gastro-enterostomy, with Murphy's button, is the safest and quickest way of establishing an anastomosis in benign obstruction of the pylorus.

In attempting to ascertain the remote results of pyloroplasty and gastro-enterostomy, we must first inquire into the frequency of relapses. The latter may result after pyloro-

plasty, from a further contraction of cicatricial tissue at the pylorus, or from cicatrization of an ulcer, open at the time of operation, or they may be due to the formation of adhesions of the previously movable pylorus in an unfavorable and high position, leading to dilatation, sagging, and valve-formation. Some authors attribute occasional failures to dilatation, followed by weakening of the muscular coats of the stomach. This condition is certainly very rare in benign stenosis, in which, on the contrary, we know that muscular hypertrophy of the stomach wall usually coexists, commensurate with the degree of obstruction to be overcome. In long-standing cases of stenosis and dilatation, atrophy of the muscular tissue can finally supervene. Carle and Fantino report three cases, which may be mentioned here. They were cases of atony, all accompanied by moderate, though well-marked, stenosis of the pylorus, and in all of them pyloroplasty was soon followed by a recurrence of symptoms.

After gastro-enterostomy, a relapse can only occur from narrowing of the anastomotic opening. No doubt the opening contracts with the stomach, as the latter resumes its normal size and shape. Chlumsky speaks of ten autopsies after gastro-enterostomy by suture, and in one of them only were the conditions found satisfactory, as regards the size of the opening. He attributes this contraction mainly to inaccurate suture of the mucous membrane. Perhaps it may also be due, in case of suture, to the broad area of apposition which is avoided by the button, especially when applied according to the method of Carle and Fantino. I have not had occasion to examine a button anastomosis between the jejunum and the stomach. But I have closely examined two implantations of the ileum into the colon, by the aid of the button, nine and fifteen months after operation, and have found most perfect union, and not the slightest contraction. This may be otherwise in the case of the thick wall of the stomach, but certainly the clinical reports do not prove it. A new sphincter apparently forms after gastro-enterostomy, gradually becoming stronger in the course of several months, permitting evacuation

of the stomach only at certain intervals. Ample proof of its existence has been given by Dunin, Carle, and Kausch, who have inflated the stomach without noticing an escape of gas into the small intestine. That the pylorus also resumes its function after pyloroplasty hardly needs mentioning, and even after resection of the pylorus for benign stenosis, a new sphincter probably forms (v. Imredy).

The influence of resection of the pylorus, pyloroplasty, and gastro-enterostomy upon disturbed motility and secretion following benign obstruction, has been studied by Mintz, Rosenheim, Dunin, Koevesi, Muendler, Stendel, and especially by Carle and Fantino, and by Kausch. Upon the results of like investigations, after resection of the pylorus for benign obstruction, I will not enter further than to say that several investigators have found a perceptible decrease in dilatation and acidity, entire disappearance of motor insufficiency, and sometimes even a complete return to normal conditions.

The results of such investigations after gastro-enterostomy are, to a certain extent, conflicting. They can, however, be made to harmonize, when we consider that the observations have been made at various intervals after operation. It is not unusual to find immediately after gastro-enterostomy that motor insufficiency continues for weeks and even months; but this condition fortunately disappears later on, and the patients regain perfect health. If, therefore, the examination is made early in the case, we will not get a fair estimate of the final result. Mintz seems to have fallen into this error when he states that evacuation of the stomach is retarded after gastro-enterostomy for benign stenosis; though another investigator (Rosenheim), who examined four post-operative cases, finds motor function permanently retarded. Later observers, however, who have made by far the largest number of investigations (Carle and Fantino, Kausch), assert that the motor function of the stomach is increased; in other words, that the contents of the latter are voided into the small intestine at an earlier period than under normal conditions. Hyperacidity, which is almost always present in benign stenosis, is concur-

rently influenced with motor insufficiency, by gastro-enterostomy. It also disappears, and hydrochloric acid is found in normal, and very frequently in subnormal quantities only. On the other hand, it has been shown that gastro-enterostomy is followed by a reflux of bile, and perhaps of pancreatic juice, into the stomach. Carle and Fantino speak of this as existing for many months, but Kausch has observed it years after operation, and even asserts its presence when entero-anastomosis has supplemented gastro-enterostomy. Others have lately found that entero-anastomosis entirely side-tracks the bile from the stomach. Kausch mentions, however, only one case in which reflux of bile caused any disagreeable symptoms, and that was in a highly neurasthenic individual. Finally, all observers agree that the capacity of the stomach is reduced after gastro-enterostomy, but the latter never regains its normal size.

After pyloroplasty, the motor function and the secretion change in a different ratio. On the whole, it may be said that the resumption of normal motor function is slower than after gastro-enterostomy, and that hyperchlorhydria, in consequence, also disappears more slowly. But the quantity of hydrochloric acid is never reduced below the normal. The dilated stomach never entirely regains its normal size, and less frequently approaches it than after gastro-enterostomy. Immediately after the operation, large quantities of bile may pass through the pylorus into the stomach for a few days, but this reflux ceases very quickly until, according to some, no bile is found in the stomach, according to others, at times, only a very small quantity.

Are we justified in drawing conclusions as to the value of both procedures? I feel we may say that in well-selected cases the final results of pyloroplasty are as good as those of gastro-enterostomy, both immediate and remote. In cases in which there is no fixation of the pylorus, and where the latter is not the seat of much inflammatory thickening, in which, also, there is not too much dilatation of the stomach and weakening of its walls, pyloroplasty is as safe an operation as posterior gastro-

enterostomy with the button; safer, perhaps, than gastro-enterostomy with sutures. It is, furthermore, free from post-operative complications, which are immediately traceable to the abnormal intestinal circulation established by gastro-enterostomy, such as the well-known vicious circle, and the compression of the intestines by one another,—all complications which, however, nowadays are very rare, or do not affect the final result. But pyloroplasty has one regretable feature,—the uncertainty of the result, in some cases, in which its employment might appear indicated. Aside from the further shrinkage of cicatricial tissue at the pylorus and the contraction following cicatrization of an open ulcer after operation, peripyloric adhesions may form where none have previously existed. The musculature of the stomach may be weakened, and, although the pylorus has become patent enough, a certain amount of motor insufficiency will obtain, and with it an imperfect operative result. When the results of two operations are about equal, and one of them offers greater assurance of success in every case, it should always be the operation of choice.

BIBLIOGRAPHY.

Finkelstein, H.: "Angeborene Pylorusstenose im Sauglingsalter," Jahrb. f. Kinderh., 1896, Band xliii.

Gran, Chr.: "Bemerkungen uber Magenfunction und die anatomische Veraenderungen bei angeborener Pylorusstenose," Jahrb. f. Kinderh., 1896, Band xliii.

Schwyzer, F.: "A Case of Congenital Hypertrophy and Stenosis of the Pylorus," New York Med. Journ., 1896, p. 674.

Schwyzer, F.: "Another Case of Congenital Hypertrophy and Stenosis of the Pylorus," New York Med. Journ., 1897, p. 726.

Thomson, John: "On Congenital Gastric Spasm; Congenital Hypertrophy and Stenosis of the Pylorus," Scott. Med. and Surg. Journ., 1897, p. 511.

Sonnenburg: "Vorstellung eines Knaben an dem Pyloroplastik vorgenommen wurde," Centralb. f. Chir., 1898, No. 1, p. 25.

Rolleston and Hayne: "Case of Congenital Hypertrophy of the Pylorus," Brit. Med. Journ., April 23, 1898.

Meltzer, S. J.: "On Congenital Hypertrophic Stenosis of the Pylorus," New York Med. Record, May 14, 1898.

Meltzer, S. J.: "Congenital Hypertrophic Stenosis of the Pylorus," New York Med. Record, August 20, 1898.

Stern: "Ueber Pylorusstenosen beim Saugling nebst Bemerkungen uber deren chirurgische Behandlung," Deutsche med. Wochens., 1898, No. 38, p. 601.

Pfaundler, M.: "Zur Frage der sogenannten kongenitalen Pylorusstenosen und ihre Behandlung," Wiener klin. Wochens., 1898, Nos. 45 and 52.

Cautley: "Congenital Hypertrophic Stenosis of the Pylorus," Lancet, November 12, 1898, p. 1264.

Abel, W.: "Erster Fall von erfolgreicher Gastroenterostomie wegen angeborener stenosirender Pylorushypertrophie bei einem achtwochigen Saugling," Münch. med. Wochens., 1899, No. 48.

Rosenheim, Th.: "Ueber stenosirende Pylorushypertrophie bei einem Kinde," Berl. klin. Wochens., August 7, 1899.

Neurath, R.: "Die angeborene (hypertrophische) Pylorusstenose," Centralb. f. d. Grenzgeb. d. Med. u. Chir., 1899.

Batten, F. E.: "Case of Congenital Hypertrophy of the Pylorus in an Infant," Lancet, December 2, 1899.

Hansy, F.: "Ein Fall von angeborener stenosirender Pylorusstenose," Wiener klin. Wochens., March 8, 1900.

Pfaundler, M.: "Ueber Magencapacitat und gastrektasie im Kindesalter," Bibliotheca Med. Stuttgart, 1898, Abth. Dl., Heft 5.

Thayer, W. S.: "Note on a Case of Cicatricial Stenosis of the Pylorus following a Peptic Ulcer," Johns Hopkins Hosp. Bulletin, 1893, Vol. iv, No. 31.

Hirsch, Hr.: "Vorstellung eines Falles von gutartiger Pylorusstenose. Heilung durch Gastroenterostomie," Berl. klin. Wochens., November 9, 1896.

Hartmann, H.: "Le rétrécissement cicatriciel du pylore consécutif aux brûlures et son traitement," 10 Congrès franc. de Chirurg., Paris 1896, p. 424.

Boas, J.: "Ueber hypertrophische Pylorusstenose stenosirende gastritis und deren Behandlung," Arch. f. Verdauungskr., 1898, Vol. iv, p. 47.

Kroenlein: "Ueber Ulcus und Stenosis des Magens nach Trauma," Mitth. a. d. Grenzgeb. d. Med. u. Chirur., 1899, Vol. iv.

Cohnheim, P.: Arch. f. Verdauungskr., Band i, Heft 4.

Lindstrom, E.: Hygeia, September, 1899, p. 267.

Petry: "Ueber subcutane Rupturen und Contusionen des Magendarmkanal," Beitr. z. klin. Chir., Band xvi, p. 545.

Stern, R.: "Ueber traumatische Erkrankungen der Magenschleimhaut," Deutsche med. Wochens., 1899, No. 38.

Webster, J.: "Case of Bony Tumor obstructing the Pylorus," Lond. Med. and Physical Journ., 1827, N. S., Vol. ii.

Hutchinson: "Large Cyst in the Coats of the Stomach," Trans. of the Path. Society, London, 1857, Vol. viii, p. 218.

Finnell: "Specimen of Cystic Tumor connected with Stomach; Cancer of Pylorus," New York Med. Journ., 1874, Vol. xx, p. 641.

Sangalli: "Storia clinica anatomica dei Tumori," Pavia, 1860, Vol. ii (Ref. Virch. Krankh. Geschwuelste, Band iii, p. 132).

Betz, Fried.: "Stenosirung des Pylorus durch eine Schleimhautfalte," Memorabilien (Heilbr.), 1884, p. 22.

Pernice: "Stenosi del piloro per loiomioma," Sicilia Medica, Palermo, 1890, A. 2, p. 455.

Stevens, J. B.: "Case of Multiple Polypi in the Stomach," Glasgow Med. Journ., June, 1896.

Anderson, H. B.: "Multiple Cysts of Stomach and Small Intestines," Brit. Med. Journ., February 12, 1898.

Herhold: "Zur Casuistik der Myome des Magens," Deutsch. med. Wochens., 1898, No. 4, p. 60.

Steiner, R.: "Ueber Myome des Magendarmkanals," Beitr. z. klin. Chirurg., 1898, Band xxii.

Skliffossowsky: "Ueber gutartige paillare Geschwuelste der Magenschleimhaut," Virch. Arch., 1898, Vol. cliii, p. 130.

Bennett, W. H.: "A Clinical Lecture on Some Cases of Dilatation of the Stomach considered from the Surgical Aspect," Brit. Med. Journ., February 3, 1900, p. 241.

Einhorn, M.: "Syphilis of the Stomach," Phila. Med. Journ., February 3, 1900.

Durante: "Les résultats de la cure opératoire des rétrécissements du pylore," La Semaine Méd., 1893, p. 511.

Pepper, William: "Cases of Diseased Gall-Bladder," Am. Journ. of Med. Sci., 1857, Vol. xxxiii.

Bouveret, L.: "Stenose du pylore adhérent a la vésicule calculeuse," Revue de Médicine, 1896, xvi, p. 1.

Alex, Emile: "Stenose du pylore d'origine biliaire," Thèse de Lyon, 1896.

Jaboulay and Tournier: Province Med., July 8, 1897.

Tuffier and Marchais: "Des rétrécissements du pylore d'origine hépatique," Revue de Chirurg., 1897, No. 2.

Fleischhauer: "Stenosis of the Pylorus through Gall-Stone," Deutsch. med. Wochens., 1899, No. 17.

Schnitzler, J.: "Ueber einen Krampftumor des Magens, nebst Bemerkungen zum sogenannten Spasmus pylori," Wiener med. Wochens., 1898, No. 15, p. 681.

Ogston, A.: "A Study on the Treatment of Non-Malignant Stricture of the Pylorus," Lancet, March 23, 1895, p. 739.

Hemmeter, J. C.: "Versuche ueber Intubation des Duodenum," Arch. f. Verdauungskrankh., 1896, No. 2, p. 85.

Kuhn, Franz: "Methodik der Metallspiralsondirung," Deutsch. med. Wochens., 1897, p. 571.

Kuhn, Franz: "Sondirungen am Magen, Pylorus und Duenndarm des Menschen," Arch. f. Verdauungskrankh., 1898, Vol. iii, p. 19.

Albertoni: "Breve relazione della divulsion digitale del piloro, operata dal Prof. Loreta in 2 casi" (Ref. Centralb. f. Chirurg., 1883, p. 190).

Hagyard, R.: "A Case of Non-Malignant Pyloric Obstruction; Dilatation of the Pyloric Orifice; Recovery," Brit. Med. Journ., February 19, 1887, p. 386.

Treves, Fr.: "A Successful Case of Loreta's Operation on the Stomach," Brit. Med. Journ., 1889, Vol. i, p. 1105.

Bull, William T.: "Case of Cicatricial Stenosis of the Pylorus relieved by Loreta's Operation," New York Med. Rec., June 8, 1889.

Swain, Paul: "Two Fatal Cases of Loreta's Operation," Lancet, January 9, 1892, p. 87.

Jaboulay and Brian: "Gastroenterostomies; Dilatation du pylore," Lyon Méd., 1896, October 25, p. 253.

Hatch, W. K.: "A Case of Obstruction of the Pylorus from Spasm of the Sphincter; Loreta's Operation; Recovery," Lancet, October 23, 1897, p. 1046.

Taylor, J. W.: "A Case of Pyloric Stenosis treated first by Loreta's Operation and afterwards by Posterior Gastro-enterostomie" (Doyen), Lancet, November 13, 1897, p. 1335.

Morella, G.: "Contributo alla chirurgia dello stomaco," Rivista Veneta do Scienze Mediche, 1898, Vol. xxix.

Steele, Ernst: "A Case of Exploratory Operation for Dilatation of the Stomach," Brit. Med. Journ., February 24, 1900.

Mondrofit, A.: "Arch. provinc. de chirurg.," January, 1898, Vol. vii, p. 50.

Murrell, William: "Dilatation of the Stomach; Operation successful," Med. Press and Circ., November 2, 1898.

Murrell, William: "Clinical Lecture on Dyspepsia or Gastric Dilatation," Med. Press and Circ., January 25, 1898.

Einhorn, M.: "Diagnosis and Treatment of Stenosis of the Pylorus," N. Y. Med. Rec., January 19, 1897.

Lentaigne, J.: "Case of Pyloroplasty for Non-malignant Stricture of Pylorus; Recovery," Trans. Royal Acad. Ireland, 1898, Vol. xv, p. 302.

Beach, H. H. A.: Bost. Med. and Surg. Journ., 1897, p. 359.

Page: "Notes on a Successful Case of Pyloroplasty," Brit. Med. Journ., April 3, 1897, p. 845.

Hind, W.: "Pyloroplasty for Non-malignant Stricture of the Pylorus," Med. Press and Circ., September 8, 1897, p. 349.

Cavazzani, G.: "Stenosi Pilorica; Gastrectasia; Piloroplastica," Rivista Veneta di Sc. Med., 1897, Vol. xxvi, p. 349.

Mayo, W. J.: "Cicatricial Stenosis and Valve Formation as a Cause of Pyloric Obstruction; Five Cases relieved by Operation," Journ. Amer. Med. Assoc., October 16, 1897.

Einhorn, M.: "Ein weiterer Beitrag zur Kenntniss der Ischochymie (Gastrectasi)," Zeitschr. f. klin. Med., 1898, Vol. xxxv, p. 418.

Selenkoff, A.: "Zur operativen Behandlung der Pylorusstenosen," St. Petersb. med. Wochenschr., 1898, p. 97.

Morrison, R.: "On Pyloroplasty with Abstract of Eleven Consecutive Cases," Lancet, February 26, 1898, p. 561.

Garre: "Beiträge zur Magenchirurgie," Münch. med. Wochenschr., 1898, No. 37, p. 1165.

Roberts, J. B.: "Pyloroplasty for Non-malignant Stenosis," ANNALS OF SURGERY, April, 1900, p. 503.

Imredy, Bela v.: "Ueber Function des Magens nach Pylorusresection," Wiener med. Presse, 1894, No. 13.

Grundzach, A.: "Indication zur Pyloroplastik, Pylorektomie, und Gastroenterostomie," Therapeut. Monatsheft, March, 1895, Part III, p. 130.

Talma, S.: "Die Indicationen zu Magenoperation," Berl. klin. Wochenschr., 1895, No. 25, p. 537.

Boyen, E.: "Traitement chirurgical des affections de l'estomac et du duodenum," Paris, 1895.

Doyen, E.: "Chirurgie de l'estomac. Résultats eloignes." 10 Congres de Chirurgie, Paris, 1896, p. 423.

Doyen, E.: "Chirurgie de l'estomac," Revue de Chirurgie, 1896, p. 868.

Souligoux, Ch.: "Gastroenteroanastomose," Presse Méd., June 22, 1896, p. 348.

Chaput: "Procédé de gastroenterostomie sans ouverture de la muqueuse," Bull. de la Soc. Anatomique de Paris 27, 1896.

Roux: "A propos de la gastroenterostomie," 10 Congres f. d. Chirurgie, Paris, 1896, p. 431.

Jaboulay: "Nouveaux faits de chirurgie stomacale," Arch. prov. de chirurg., 1896, No. 5, p. 641.

Porges, Robert: "Beiträge zur Magenchirurgie," Wiener klin. Wochenschr., 1897, p. 310.

Dubourg: "La gastroenterostomie dans les stenoses simples du pylore," Revue de Chirurgie, 1897, p. 1029.

Faure, J. L.: "Sur un nouveau procédé de gastroenterostomie; la gastroenterostomie par invagination," Revue de Chirurgie, 1897, p. 1029.

Cordier, A. H.: "Gastrojejunostomy in Gastrectasis," N. Y. Med. Rec., September 25, 1897.

Chauffan, G.: "Stenose pylorique et vaste dilatation de l'estomac." Société méd. des Hôpitaux, July 9, 1897—October 22, 1897.

Hagen, G.: "Note sur les variations de la capacité stomacale dans les stenoses pyloriques," Société méd. des Hôpitaux, November 1897.

van Kleef: "Weekblad van het Nededlandsch Tydschrift voor Geneeskunde," August, 1898, Vol. ii, p. 205.

v. Chlumsky: "Ueber die gastroenterostomie," Beitr. z. klin. Chirurgie, Bd. xx, 1896.

Roman v. Baracz: "Werth der Anastomose mittelst Plättchenaht nach Senn," Arch. f. klin. Chirurgie, Bd. xviv, p. 554.

MacArdle: "The Surgery of the Stomach," Dubl. Journ. Med. Sciences, 1898, Vol. cv, p. 97.

Kocher, Th.: Correspondenzbl. f. Schweiz., Aertzte, No. 20, 1898.

Keen, W. W.: "The Cartwright Lectures on Surgery of Stomach," N. Y. Med. Journ., Vol. lxvii, 1898.

Weir, Robert T.: "On the Operation of Gastroenterostomy conjoined with Entero-anastomosis," N. Y. Med. Rec., April 16, 1898.

Hartmann: La Semaine médicale, 1898, p. 7.

Tuffier, Th.: "Traitement chirurgical des étrécissements du pylore," Presse Méd., 1898, p. 73.

Kappeler, O.: "Erfahrungen ueber Gastroenterostomie," Deutsch. Zeitschr. f. Chirurgie, Band l, Heft 4.

Stendel: "Die in den letzten Jahren an der Czernyschen Klinik ausgeführten Magenoperationen und die Endresultate der früheren Operationen," Beitr. z. klin. Chirurg., 1899, Bd. xxiii, p. 1.

Salzer, Hans: "Die Magen-darm-operationen in den Jahren 1894-5 und 1897-8," Zeitschr. f. Heilkunde, 1899, Bd. xx, p. 75.

Hartmann and Soupault: "Les résultats éloignés de la gastroenterostomie," Revue de Chirurg., 1899, pp. 137 and 330.

Degny: Belgique médicale, February and March, 1899.

Ziegler: "Geheilte Perforation eines Magengeschwüres mit Pylorusstenoses nach angelegter Gastroenterostomie," Münch. med. Wochenschr., 1899, No. 17, p. 554.

Lindner and Kuttner: "Die Chirurgie des Magens," Berlin, 1898.

Hahn, E.: "Ueber einige Erfahrungen aus dem Gebiete der Magendarm Chirurgie," Deutsch. med. Wochenschr., No. 41, 1897.

Mintz, S.: "Ueber die chirurgische Behandlung der Magenkrankheiten von therapeutischen Standpunkte aus beurtheilt," Zeitschr. f. klin. Med., 1894, No. 25, p. 123.

Rosenheim, Th.: "Ueber die chirurgische Behandlung der Magenkrankheiten," Deutsch. med. Wochenschr., 1895, No. 1, p. 11.

v. Hacker: "Ueber Magenoperationen bei carcinom und bei narbigen Stenosen," Wiener klin. Wochenschr., 1895, No. 33, p. 589.

Muendler: "Die neuerdings an der Heidelberger chirurgischen Klinik ausgeführten Operationen am Magen," Beitr. z. klin. Chirurg., 1896, No. 15, p. 293.

Siegel: "Ueber die functionellen Erfolge nach Operationen am Magen," Mitth. aus der Grenzgeb. der Med. und Chirurgie, 1896, Bd. i, p. 347.

Trzebicky, R.: "Ueber chirurgische Intervention bei Magenkrankheiten," Die Heilkunde, Wien, May, 1898, p. 465.

Kovesi, G.: "Einfluss der Gastroenterostomie auf die Secretions Vorgange des Magens," Münch. med. Wochenschr., 1898, No. 2, p. 1081.

Kausch, W.: "Ueber functionellen Ergebnisse nach Operationen bei gutartigen Erkrankungen," Mitth. a. d. Grenzgeb. d. Med. u. Chirurg., 1899, Bd. iv.

Carle and Fantino: "Beiträge zur Pathologie und Therapie des Magens," Arch. f. klin. Chirurg., Bd. lvi, Heft 1.

THE SURGICAL TREATMENT OF SIMPLE DILATATION OF THE STOMACH AND OF GASTROPTOSIS.[1]

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BEFORE speaking of gastric dilatation and of gastroptosis, we must describe the normal limits of the stomach. As the surgeon will meet only with well-marked examples of the lesions, he need not concern himself greatly with the still active discussion as to the exact limits of the stomach,—a question which is so difficult to determine. He may take as normal the position advocated by Luschka (*Die Lage der Bauchorgane des Menschen*, 1873) and so ably supported by Meinert (*Centralblatt für innere Medicin*, 1896, p. 297). The cardiac orifice, according to these authorities, is fixed almost immovably at the level of the twelfth thoracic vertebra, and the pylorus lies behind a point on the free edge of the right costal border which would be intersected by a horizontal line passing through the tip of the ensiform cartilage. The lesser curvature passes from the latter point across the median line and then almost vertically upwards, forming a half circle around a line passing horizontally backward through the tip of the ensiform cartilage. According to Pacanowsky (*Deutsche Archiv f. klin. Med.*, 1887, xl, p. 342), when the healthy stomach is slightly distended, the lower limit of the organ, as determined by percussion, lies in the parasternal line three to five centimetres above the umbilicus in males, and four to seven centimetres above it in females. It is mani-

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festly of little importance to the clinician whether this percussion line coincides with the actual position of the lower border of the stomach or not, for he seeks only to ascertain the difference between the position of the stomach in health and in distention or in descent. Any error which belongs to the method of percussion would affect both cases in the same way, giving the line in each case too high or too low. He therefore need not attempt to settle the accuracy of the claim made by Martius and Meltzing based on a study of the limits of the stomach as found by examination with the diaphanoscope of Einhorn, that the greater curvature really descends much below this level (*Zeitschr. f. klin. Med.*, xxvii, 1895, Heft 3 and 4, p. 1893). Nor need he decide whether the extreme views of Doyen (*Archives prov. de. Chir.*, iii, p. 673, and "Traitement chir. des affections de l'estomac," Paris, 1895), as to the vertical position of the lesser curvature and the fish-hook-like shape of the antrum pylori are correct. In any case it remains certain that in the absolutely normal relations of the parts and with a normal thorax the pylorus is so sheltered as to be scarcely palpable, and that the lesser curvature will be entirely out of reach of the palpating hand, therefore, whenever these parts can be felt, we may assume that they have descended below their normal position, and that a more or less marked gastroptosis is present, whether it is sufficient to be considered such from a pathological point of view or not.

(A) *Gastrectasia.*—The clinical term gastrectasia, or dilatation of the stomach, means something more than simple enlargement of that organ. The stomach may be considerably enlarged in individuals accustomed to coarse food, or to taking excessive amounts of solids and fluids, and yet the functions of the organ may not be disturbed and the walls may become sufficiently hypertrophied to deal with this abnormal quantity without difficulty. If this hypertrophy gives way to atony, or if hypertrophy should not take place, we have added the second factor in our idea of dilatation as a pathological condition, that is, motor insufficiency. We may therefore define gastrectasia as an enlargement of the stomach with motor insuffi-

ciency. As a result of the impairment of its muscular power, the stomach never completely empties itself, and the contained food constantly tends to increase in amount and undergoes fermentative changes. The motor insufficiency of which we speak is a relative insufficiency, a disproportion between the muscular power and the resistance to be overcome; hence, we may have normal muscular walls but an increased resistance at the outlet of the stomach, or normal conditions at the outlet but feeble muscular walls. In either case gastrectasia will generally follow, that is, an obstructive dilatation in the first place, and an atonic dilatation in the second. All obstructions at the pylorus are not followed by gastrectasia, because in many cases the hypertrophy of the muscular wall is sufficient to overcome the resistance and empty the stomach, a compensated condition being established similar to that often observed in valvular lesions of the heart. But all cases of simple motor insufficiency are not followed necessarily by dilatation, for the patient may not put more food in the stomach than the latter can pass on into the intestine without leaving an increasing residue behind.

With the obstructive form of dilatation we have nothing to do at present, as that is fully dealt with by others in this discussion. We may remark, however, that the treatment of this form consists in removal of the obstruction and in providing for a thorough drainage of the large pouch formed by the displaced greater curvature. In obstructive dilatation, the pylorus will be found generally displaced downward to such an extent as to give favorable drainage of the pouch when the new pylorus has been established, and the stomach seldom fails to recover its original dimensions when the resistance at the outlet is removed. In the exceptional cases in which dilatation remains after this relief, it may be that the pylorus has remained fixed in its normal position in spite of the dilatation, the stomach assuming the shape of the letter U as it dilates. In these exceptional cases gastro-enterostomy will be a better operation than attempting to overcome some be-

nign obstruction of the pylorus by pyloroplasty or pylorectomy. We shall refer to the operation of gastroplication later.

The usual cause of atony of the muscles of the stomach is some constitutional weakness (such as phthisis or chlorosis) which impairs the nutrition of the gastric muscles, and the custom of overloading the stomach with food or drink, especially with hasty habits of eating. Atony has also been observed as a reflex condition dependent upon the presence of an epigastric hernia. Atonic dilatation is very frequently associated with gastroptosis, although the best authorities seem unable to agree upon the exact relation of the two. It is agreed, however, that gastroptosis may result from the weight of an enlarged stomach stretching its attachment and causing its descent; and on the other hand that gastroptosis may obstruct the escape of food from the stomach and cause an obstructive dilatation. Both of these relations of cause and effect appear to apply only to a few cases at either end of the chain; while in the great majority of cases the gastrectasia and gastroptosis seem to be due to some common cause affecting the general nutrition of the body, sometimes with a strong element of nervous origin, just as neurasthenia and anæmia are connected.

The conditions hitherto mentioned result in a chronic dilatation, developing in the course of months or years; but there are a few extraordinary cases on record of acute dilatation of the stomach with violent symptoms generally resulting in death.

Some authors include in this class the cases of extreme overloading of the stomach with food, usually accompanying an alcoholic debauch, which often end fatally, but are sometimes cured by the use of the stomach-tube and by careful treatment. But in our opinion the cases of acute over-eating should be separated from those to which we have alluded, and which run the extraordinary course shown in the following case reported by Brown (*Lancet*, October 14, 1899, p. 1017).

A man fifty-five years old was admitted to hospital with the diagnosis of intestinal obstruction. While in his usual good

health, two days before admission, he had been seized with an intense pain in the abdomen and vomiting, which had continued nearly up to his admission. He was then in great pain, with marked symptoms of collapse. The abdomen was distended just above the pubes, flattened laterally and in the epigastrium, and dulness, fluctuation, and succussion could be obtained over the swelling. The abdomen was not tender to pressure. No urine had been passed since the beginning of the attack, but the introduction of a catheter brought only a drachm of bloody urine. The bowels had moved slightly before admission. An exploratory laparotomy revealed a cystic-looking tumor, which was opened and found to contain gas and a thick, dark, greenish fluid to the amount of three pints. On the supposition that the cavity was a pancreatic cyst, its walls were attached to the edges of the abdominal wound for drainage. The patient was relieved of pain by the operation, but succumbed five hours later. The autopsy showed that the supposed cyst was a displaced and distended stomach, with a capacity of five pints or more. There was no pyloric obstruction. The kidneys were saccular and inflamed.

Cases of this nature have been observed to follow a blow upon the abdomen, and operations upon the gall-bladder or stomach, and are marked by the accompanying suppression of urine. Vomiting may or may not be present. Some refer the dilatation to spasm of the pylorus, others to paresis of the stomach wall. Brown and Robson (*Lancet,* March 4, 1900, p. 832) refer to experiments of Carion and Hallion which showed that section of the pneumogastric nerves in dogs was followed by dilatation of the stomach and symptoms resembling uræmia, the latter being supposed to be caused by absorption of toxins from the contents of the dilated stomach. The resemblance between the results of this experiment and the cases just described is very suggestive. Whatever the cause may be, it would appear that the use of the stomach-tube and medical treatment would fulfil the indications sufficiently, and would give more chance for recovery than a laparotomy could offer in a condition accompanied by such prostration.

Although chronic atonic dilatation of the stomach without obstruction of the pylorus is not uncommon in its milder

grades, it is very rarely found so exaggerated as to demand surgical interference.

The symptoms of atonic gastrectasia are a feeling of weight and fulness of the stomach after eating, but without pain, and often without impairment of the appetite. There is great thirst, for water is not absorbed by the stomach, and is very slow in reaching the intestine. Vomiting may be absent if there is no obstruction at the pylorus. Dyspnœa, headache, dizziness, constipation (occasionally diarrhœa) with marked emaciation are also found. There may be eructations of gas and boborygmi. The pulse is apt to be slow, even down to forty beats to the minute. The urine is scanty and concentrated.

Physical examination shows enlargement of the stomach by the various tests of inspection, palpation, and percussion. Peristaltic waves will be absent, as they indicate a stenosis of the pylorus with muscular hypertrophy. Succussion will be found at a much greater interval after eating than that at which it would be found in a normal stomach. The stomach should always be fully distended for examination by the bicarbonate of soda or the inflation methods. The stomach-tube will show the retention of food in the stomach long after it should have been passed on into the bowel. The motor insufficiency can also be tested by administration of salol, and Riegel remarks that the delayed disappearance of the characteristic action of ferric chloride on the salicylic acid in the urine (Huber) is a far more reliable sign of motor insufficiency than is a delayed beginning of the reaction. (In Nothnagel's "Specielle Pathologie und Therapie," xvi, 2, p. 457.) The salicylic reaction should cease in twenty-six or twenty-seven hours after its appearance in healthy individuals. The main point in the diagnosis is a distinction between gastrectasia and gastroptosis, as in both the lower limit of the stomach will be found lower than normal, and this is made by ascertaining the level of the lesser curvature, as will be described later.

There is no characteristic chemical change in the contents of the stomach in atonic dilatation, for these changes depend

upon the cause of the distention or upon the resultant or complicating disease of the mucous lining of the organ. Evidences of delayed digestion and of fermentation will usually be found.

The prognosis of atonic dilatation of extreme degree is not very favorable, but the changes are much slower in development than those of the similar condition of obstructive dilatation. Although such extreme grades of the lesion are rarely seen, an operation is indicated whenever a point is reached when lavage and medical and dietetic treatment fail to maintain the nutrition of the patient, as shown by a continuous loss of weight and strength. It is also indicated (and Riegel also suggests this) when the patient loses ground as soon as medical supervision is discontinued, or when his circumstances do not admit of the care and special diet which he requires long after he is discharged from actual medical treatment.

The surgical treatment of atonic dilatation may consist in gastroplication or in gastro-enterostomy.

Gastroplication, introduced by Bircher (*Correspondenz Blatt für schweizer Aerzte*, 1891, p. 713), whose efforts were seconded by Weir (*New York Medical Journal*, 1892, July 9, p. 29), is an operation which reduces the size of the stomach by folding its walls in upon themselves, retaining the folds by sutures. It has sometimes been called gastrorrhaphy, but this title should be reserved for the newer operation done for gastroptosis, by analogy with nephrorrhaphy. Robson (*Lancet*, March 24, 1900, p. 831) gives a list of twenty-eight cases taken from literature, including one of his own, with a mortality of two cases, or 7 per cent. One of the fatal cases, however, succumbed in syncope two weeks after the operation, and the death can hardly be ascribed to the operation. In fifteen cases no subsequent report was obtained, and in two others the case was followed only a few weeks, the condition being satisfactory up to that time. In one case pyloroplasty was done at the same time. In three others there was a stricture of the pylorus which in one case was left untreated, and in the others was subjected to pylorectomy and to pyloroplasty later.

Deducting all these there are only six cases by which to estimate the permanent results of the operation. Four of these patients (Bircher) were well 3, 3, 2½, and 1 year after the operation; the others were well about one year and three months respectively (Moynihan, Hartmann).

It may well be claimed, then, that the operation will in properly selected cases give good results; but the difficulty lies in the selection. Weir's operation was performed because the stomach failed to regain its normal size after pyloric obstruction had been relieved, and the indication was clear, but such cases are extremely rare. Among the cases just enumerated there was one in which pyloroplasty was done at the same time, and experience teaches us that in such cases the gastroplication is unnecessary. There are three cases, also, in which a stricture of the pylorus was operated upon at a later date or left untouched, and these were clearly cases in which the gastroplication should not have been done. It will be easy, as a rule, to recognize the more evident causes of pyloric obstruction, cicatrices, tumor, adhesions, etc., and all of these conditions contraindicate gastroplication, for the obstruction itself must be removed or a gastro-enterostomy be performed. But there is one form of obstruction, spasmodic contraction of the pylorus, which may elude even careful investigation, as it has been known to disappear under deep anæsthesia. Without accepting the extreme views of Doyen and other French authorities as to the great frequency of this condition and its importance as a cause of all varieties of gastric lesions, it must be recognized as by no means uncommon. The writer himself has found and treated it successfully in two cases by pyloroplasty. Bennett's case is extremely instructive in this regard (*British Medical Journal,* February 3, 1900, p. 241). He operated upon a man with extreme gastrectasia, and finding no cause of obstruction, the pylorus seeming healthy and not thickened, he did a gastroplication. The patient remained remarkably well for a time, but the symptoms returned and death ensued, and at the autopsy the lumen of the pylorus was found contracted to the size of an English urethral bougie,

No. 14. He believes that a spasm existed at the first operation, which was not recognized either because it relaxed or because no attempt was made to introduce the finger into the lumen. Bennett quotes other cases to show the disappearance of spasm during deep anæsthesia or after death, and other surgeons corroborate this opinion (Morison, *Lancet,* February 26, 1898). It is evident from these facts that the examination of the pylorus should be made with the greatest care, and that passage should not be declared normal unless the forefinger can be introduced into it by inverting the stomach wall.

As to the details of the operation, several modifications of Bircher's original method of inverting a longitudinal fold and securing it with a single row of sutures have been made. Weir's modification, which seems to the writer the most satisfactory of all, consists in using several lines of suture instead of a single one, thus holding broad surfaces of the stomach together, avoiding the dead space left in the fold by Bircher, and giving greater security against relapse. Brandt (*Centralblatt für Chirurgie,* 1894, p. 361) made several small parallel folds on each wall of the organ, and Bennett (*Lancet,* July 4, 1896, p. 8) made several folds on the anterior wall, a single line of sutures being passed so as to pick up the apex of every fold with every suture, all of the folds being thus secured by a single knot for each suture. The method employed appears to have had no effect upon the ultimate results.

The rival of gastroplication in these cases is gastro-enterostomy. The risk in the latter operation is of course much greater, but in skilful hands the mortality for gastro-enterostomy for any cause except malignant disease has fallen to about 10 per cent., although we can hardly grant Doyen's claim that it is absolutely free from danger. But it has the great advantage that if the surgeon should chance to overlook some cause of pyloric obstruction, his patient will be sure of a cure if he survives the operation, whereas gastroplication will be useless if pyloric obstruction exists. In conclusion, we may say that gastroplication is a good operation for those extremely rare cases of gastrectasia absolutely independent of obstruction

of the pylorus, but that nearly all cases of gastrectasia demand some more radical treatment, which will remove the cause as well as rectify the distention.

(B) *Gastroptosis.*—Gastroptosis has only recently been brought within the possibilities of surgical treatment, although the idea of at least partial descent of the stomach is older than Glenard's famous description of enteroptosis, being known by the name of "vertical stomach" at that time. By gastroptosis we understand the moving downward of the lower portion of the stomach, as evidenced by a change in position of the lesser curvature. As the cardiac orifice is fixed at the diaphragm, a complete descent of the stomach is impossible; the cardiac end remaining in contact with the diaphragm even when the greater curvature or pylorus reaches downward to the pelvis. According to Riegel (*loc. cit.*), we may distinguish three forms: (1) a descent of the pylorus to a moderate degree, bringing the lesser curvature from under the liver and into full view when the stomach is distended; (2) "vertical stomach," in which the pylorus has sunk so far as to render the lesser curvature vertical in its full extent; and (3), least common of all, a descent of the lesser curvature while the pylorus remains fixed, giving the organ a shape like the letter U. The first grade of the descent of the pylorus is so common that one seldom fails to feel the pylorus distinctly in adults unless the abdominal walls are very rigid. Meinert, indeed, claims that 80 to 90 per cent. of women have gastroptosis, although only about 5 per cent. of men are so afflicted.

According to some, the main cause for gastroptosis is the wearing of clothing which constricts the lower part of the chest, a corset or belt of any kind. Others ascribe it to various congenital or other malformations of the thorax, or any disease with enlargement of the liver or a low position of the diaphragm. In some cases it is evidently the result of loss of support below, as in women who have borne children, and who have in consequence flaccid abdominal walls. In still others it appears to be a sequel of gastrectasia; although this cannot apply to the majority of cases, as already explained. Some

have claimed that the descent of the right kidney was the beginning of gastroptosis loosening the peritoneal attachment, and causing obstruction of the duodenum by traction, with resultant gastrectasia and descent of the stomach. (In three of Rovsing's four cases of gastroptosis the right kidney was low, but there was no gastrectasia.) Glenard's theory of primary descent of the ascending colon and hepatic flexure is evidently incorrect, because this lesion is often absent in marked gastroptosis.

Considerable malposition of the stomach may exist without symptoms. There appears to be little relation between the extent of the malposition and the severity of the symptoms, although extreme cases are likely to present well-marked symptoms. When symptoms exist, they seem to be chiefly due to some obstruction to the outlet of the stomach, although the latter may not respond to this by actual dilatation. There is some difficulty of digestion, with a tendency to fermentation, eructations, and boborygmi. The motor function is disturbed, secretion is interfered with, and sometimes distinct pain is felt in the organ. Rovsing (*loc. cit. inf.*) says that there is often a characteristic pain in the umbilical and hypogastric regions, which is relieved by lying down, and not influenced by taking food unless the latter is in large amount. Nervousness, neurasthenia, hysteria, and neuralgia often accompany this condition; and it has been claimed by some that they are its results, by others that they are its cause. It may be that both views contain some truth. If the stomach becomes dilated as well as displaced, all the symptoms of that condition are added. The emaciation in these cases reaches the most extreme degree.

Physical examination will reveal the malposition, and may show dilatation of the stomach as well. On inspection the epigastrium looks depressed, the umbilical region fuller than usual. Unusual flaccidity of the abdominal walls may be evident. Peristaltic and even antiperistaltic waves may be seen to take place in the stomach. Palpation will sometimes reveal the outline of the stomach and will often elicit succussion

or splashing. Auscultation may prove useful by locating gurgling at the pylorus, indicating the obstruction here or just beyond in the duodenum. But absolutely necessary to a diagnosis from dilatation of the stomach is the distention of that organ by giving large doses of bicarbonate of soda and tartaric acid separately, or by inflation of the stomach with air through the tube. When the organ is thus distended, the lesser curvature comes at once into view, and the outlines of the pyloric end stand out clearly in an abnormally low position.

It is only recently that surgery has had anything more to offer for the improvement of this condition than the recommendation to wear an abdominal supporter. Hannecart (*Journal Médical de Bruxelles,* 1898) relates two cases operated upon by Depage five years previously by removal of a T-shaped portion of the abdominal wall, the transverse incision extending across from one eleventh rib to the other, and the vertical one from that level to the pubes, sufficient in width being removed to considerably reduce the capacity of the abdomen, and afford better support to the viscera. At the same time the ligaments of the liver were shortened and secured in the upper angle of the wound. The ultimate results of the operation were excellent. No other surgeons appear to have attempted this radical procedure. In June, 1895, Treves (*British Medical Journal,* 1896, i, p. 1) operated upon a young woman twenty-two years of age with marked enteroptosis, and found the omentum adherent to a mass of tuberculous glands in the mesentery, preventing him from raising the stomach. He removed the glands, and then could restore the stomach and liver, both of which were markedly displaced. He secured the liver in place with " three stout silk sutures. These concerned the lines of the falciform ligament and the umbilical fissure. The most important stitch was passed through the liver near its edge, and penetrated the round ligament, which afforded a most substantial holding. The other stitches involved the round ligament and the falciform ligament. Above, the sutures were passed through the fibrous structures of the parietes by the side of the xiphoid cartilage." Five months later

the patient continued in health. In 1896, Duret, of Lille (*Revue de Chirurgie*, 1896, p. 421), performed a laparotomy, making a median incision above the umbilicus, leaving the peritoneum intact in the upper half, and passed a continuous suture through the anterior wall of the stomach without penetrating to the cavity of the latter and through the undivided parietal peritoneum, at the level of the fold about the round ligament of the liver. The result was good and the patient was in excellent condition and relieved of her gastric symptoms two months afterwards. In January, 1898, Rovsing (*Archiv für klinische Chirurgie*, lx, 812) operated upon another case with a good result, and since then upon three others. Rovsing employed three silk sutures so placed as to hold a broad surface of the anterior wall of the stomach against the parietal peritoneum, leaving the pyloric region and the greater curvature free.

This operation of Duret has been named gastropexie, but by analogy with the operation of nephrorrhaphy, gastrorrhaphy would be a better title. In all there are five cases, with no operative accidents. All the patients were benefited, and one remained well eighteen months after the operation. Three were well two or three months after operation. The fifth patient died of tuberculosis in two months. In two of his cases Rovsing did nephrorrhaphy on the right kidney at the same time, and in a third as a secondary operation, with good results.

Davis (*Western Medical Review*, October 15, 1897) records two operations for gastroptosis. One occurred in a man sixty-three years of age, who had been successfully operated upon for ventral hernia a few months previously. "The stomach was drawn up to its natural position, and the lesser omentum near its reflection from the stomach was fastened to the peritoneum near the ensiform with fine silk sutures. The stomach was not greatly dilated." Reefs were taken in the mesocolon and in the mesentery also. Two months later the patient was "improved." His other case was in a woman of thirty years, with displacement of the lesser curvature of the stomach to within an inch of the umbilicus. Sutures were in-

serted in the same manner as in the first case, and a gastroplication was performed at the same time. The patient recovered.

Terrier and Hartmann ("Chirurgie de l'Estomac," Paris, 1899) record a similar operation, in a woman thirty-one years old, with dilatation and descent of the stomach. Hartmann operated, doing a gastroplication, and at the same time elevating the organ and securing it to the abdominal walls. Stengel and Beyea (*American Journal of the Medical Sciences*, 1899, cxvii, p. 667) report a case operated upon by Beyea, the sutures being differently placed, for fear that the adhesion to the abdominal wall might have disagreeable consequences. The operation was performed in April, 1898. The patient was a woman twenty-six years old, who had previously had nephrorrhaphy done with partial relief of her symptoms. The stomach lay with its lesser curvature one and one-half inches above the umbilicus. "Interrupted sutures were introduced to shorten the gastrohepatic omentum. The first suture caught the gastrophrenic ligament above at a point as near as possible to the diaphragm (a distance of about two inches from the diaphragm) and below just above the gastric vessels. The second suture was introduced about one-fourth of an inch from the first one, followed by a row of eight or ten others, to include the left three-fourths of the gastrohepatic omentum. After this had been accomplished the stomach was seen to occupy what was thought to be a normal position." Fine silk was employed. She was kept lying upon her back ten weeks after the operation. One year later the patient had gained nineteen pounds in weight and felt better and could eat freely. The lesser curvature is said to have been well supported, but the diagram given displays it as lying half-way between the ensiform and the umbilicus, much below its natural position, although considerably higher than before the operation.

To resume the facts brought out by these operations for gastroptosis, it is evident that improvement is not difficult to bring about, whether one secures the liver only, sutures the stomach itself or the mesocolon to the abdominal wall, or shortens the gastrohepatic omentum, or, finally, removes a seg-

ment of the abdominal wall. The condition is usually a complex one, and probably a simple gastrorrhaphy will not be sufficient, but should be assisted by right nephrorrhaphy, hepatorrhaphy, and in some cases, perhaps, by the Depage-Hannecart operation. In women similar supporting operations will be necessary upon the genital organs as well, in order to assure a good result.

[NOTE.—Since this paper was read, an important article by Treves, "On Ptosis of the Liver, etc.," has appeared in the *Lancet,* 1900, Vol. i, p. 1339.]

HOUR-GLASS STOMACH, AND ITS SURGICAL TREATMENT.[1]

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MORGAGNI is credited with being the first to give an accurate description of the hour-glass, double, or bilocular stomach as it has been variously termed, although it was recognized and reported at an earlier period.

The condition presents itself in two forms,—the *congenital* and the *acquired*. The former is characterized by the symmetrical contour of the constriction, and by the *absence* of pathological processes immediately connected with it, the last being the most conclusive, and, as it seems to the writer, the only positive evidence of its congenital nature. The acquired, on the other hand, is distinguished by the *presence* of pathological processes in immediate relation with the constriction. These are in the large majority of cases the cicatrices of former gastric ulcers, fresh ulcers with their attendant areas of infiltration, or the adhesions originating from these conditions and attaching the stomach to some adjacent structure. Less frequently the hour-glass deformity is produced by adhesions arising from inflammatory processes outside the stomach and involving it secondarily, in a few instances cancerous disease of a neighboring organ has brought it about, and the contraction has been caused by the cicatricial deposit following the ingestion of caustic chemicals in at least one case.

These being the distinctive features of the two varieties, the writer has preferred to classify, in this article, as con-

[1] Read before the American Surgical Association, May 2, 1900.

genital only such cases as are described as having no pathological process connected with the constriction, although a number in which this was not the case are included by those reporting them among the congenital forms. Typical examples of the congenital and the acquired forms are shown in Figs. 1 and 2.

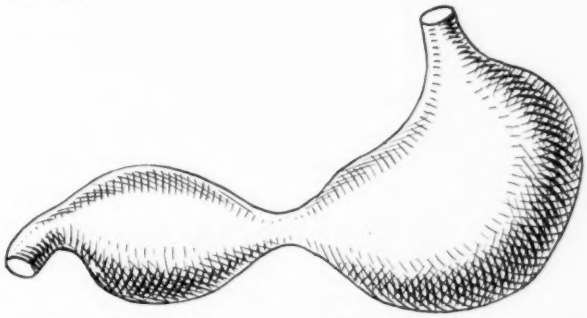


FIG. 1.—Congenital hour-glass stomach (from a specimen in the Warren Anatomical Museum, Harvard Medical School, Boston).

The following twenty cases collected by the writer are classed as congenital. Pathological processes, if present in any of these series, were remote from the constricted areas, or obviously had nothing to do with their production. All but

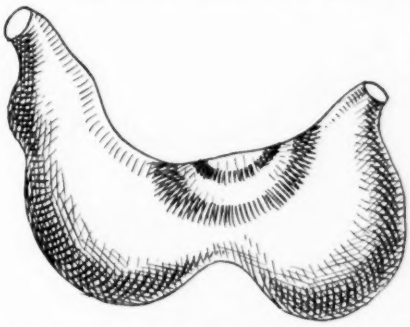


FIG. 2.—Acquired hour-glass stomach (Eiselsberg).

five of these cases are taken from Hirsch's article (*Virchows Archives,* 1895, Band cxl, Heft 3). Of the remaining five two are reported here for the first time by the writer, two by Eiselsberg (*Archiv für klinische Chirurgie,* 1899, Band lix, Heft 4, p. 825), and one by Hochenegg (*Wiener klinische Wochenschrift,* May, 1898, p. 514).

Congenital Cases.—(1) Baker (*Transactions of the Pathological Society*, London, 1866-67, Vol. xviii, p. 105). Woman, aged sixty-three. The constriction was one inch long and admitted the little finger only. There was no pathological process associated with the condition. The patient had never suffered from any illness whatever.

(2) Stoker (*Medical Press and Circular*, March 3, 1869). A woman, aged forty-three. The stomach was divided into two equal compartments by a narrow constriction in its middle. No pathological processes associated with the condition. The patient had never suffered from any gastric symptoms.

(3, 4, 5, 6, 7, 8) Carrington (*Transactions of the Pathological Society*, London, Vol. xxxiii, 1882). Carrington reports three cases, and refers to seven others, of the latter all but three are included in Hirsch's list, *op. cit.*; these three of Carrington's are (1) a specimen from St. George's Hospital Museum, (2) a case reported by Greenfield (*Transactions of the Pathological Society*, London, Vol. xxvi, p. 168), and (3) one by Peacock, Vol. i, p. 253, of the same publication. In his first three there were no pathological processes associated with the condition; in the others ulcers were present but independent of the constricted areas, which were symmetrical. In only one of these six were the age and sex of the individual known, that one was a woman aged seventy-three. In the three specimens without pathological processes the constriction was nearer the cardiac than the pyloric end of the stomach. In these three, also, the constrictions varied in size from that of a slate-pencil to that of one finger.

(9) Roger Williams (*Journal of Anatomy and Physiology*, Vol. xvii). (Ten cases, one of which is already referred to in Hirsch's list,—that of Baker,—and eight which I have classed with the acquired forms.) Constriction in middle of the stomach admits one finger, is free from pathological processes and is symmetrical, in the one clearly congenital case.

(10) Hudson (*Transactions of the Pathological Society*, London, 1887, Vol. xxxviii). A woman, aged fifty-nine. The constriction, which was of the size of the thumb, was situated a little towards the pyloric side of the middle of the organ. There were no pathological changes in connection with the strictured part, but there were some oval cicatrices of old ulcers in other parts of the stomach.

(11) (*Constriction due to rotation of the lower end of the stomach.*) Marroti (*Rivista Clinica di Bologna*, Agosto e September, p. 280, 1874). A woman, aged fifty. The stomach was constricted near its middle, apparently by the action of some transversely placed muscular bundles situated in its middle segment, which when contracting produced a marked narrowing of the stomach by making the pyloric half rotate in the long axis of the organ upon a point near its centre. (Fig. 3.)

(12) White (*Transactions of the Pathological Society*, London, 1883-84, xxxv, p. 196). Constriction admitting the thumb, no evidence of any pathological process.

(13) Saundby (*Deutsche medicinische Wochenschrift*, 1891, No. 42). Constriction five inches above the pylorus, admitting one finger only. No pathological process connected with it. A

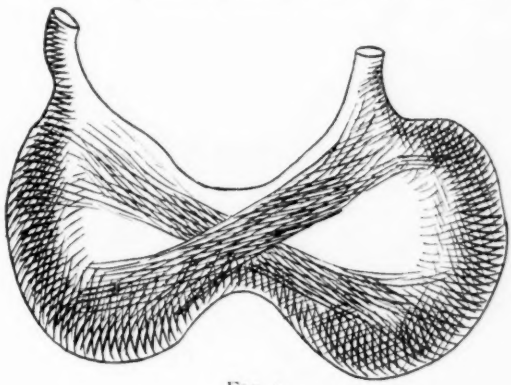


FIG. 3.

large ulcer near greater curvature had perforated and involved pancreas.

(14) Saake (*Virchows Archiv*, Band cxxxiv). A marked constriction about the middle of the stomach, due, as in case eleven, to the action of two well defined muscular bundles on the posterior wall. One of the bundles began a little beyond the pyloric end of the constriction and extended diagonally upward to be inserted on the right side of the œsophagus, the other began at the constriction and passed behind the first to be inserted in the gastrohepatic ligament. There was no pathological process connected with the stomach. Walls of pyloric part of stomach were much thicker than those of the cardiac. The specimen from a woman aged sixty-nine.

(15, 16) Watson (Boston. Not published before. Specimens from the Warren Museum of the Harvard Medical School). Clinical histories, age, and sex unknown. No pathological processes present. The first is a large stomach having a constriction, admitting two fingers, at the junction of the middle and lower thirds. The cardiac division is larger than the pyloric and its walls are thinner, being one centimetre, while in the pyloric half it is two centimetres. The constriction is smooth exteriorly and symmetrical. The mucous membrane of the constricted part, and adjacent to it on either side, is thrown into abnormally heavy ridges, which, however, are free from any pathological change (Fig. 4). The second stomach has the constriction in the same

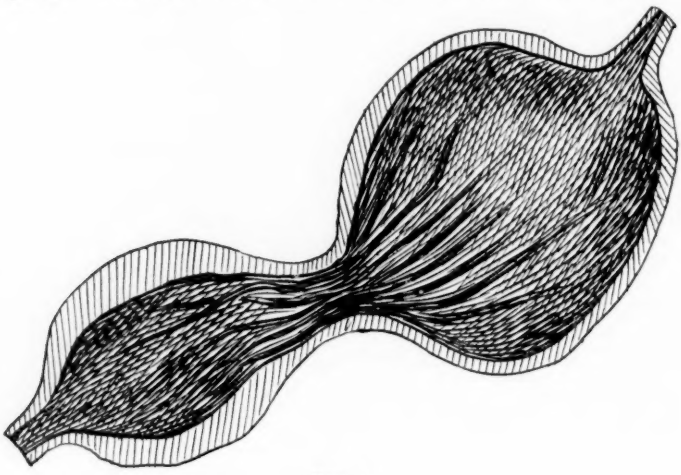


FIG. 4.

place as in the first. It allows the passage of two fingers easily. Both halves of the organ have thin walls, and there is no difference between them in this respect. The mucous membrane throughout is slightly atrophied. The constriction is smooth exteriorly and symmetrical.

(17) Hochenegg (see table of operated cases, No. 20).

(18, 19) Eiselsberg (furnished by Professor Stieda, *Archiv für klinische Chirurgie*, 1899, Band lix, Heft 4, p. 826). These two cases are illustrated by Figs. 5 and 6. There were no pathological processes associated with either.

(20) Hirsch (*op. cit.*). A woman, aged sixty-five. Since sixteenth year has suffered from gastric symptoms. These have

increased in severity since the fortieth year. Has not been able to take solid food for ten years. If she attempts to do so, vomiting always occurs. Appetite has remained good. Of late there has been a marked loss of weight and strength. (The patient died of sepsis not connected with her gastric condition.)

Autopsy.—Hour-glass stomach, constriction in the middle, three centimetres long. The larger curvature was drawn up to-

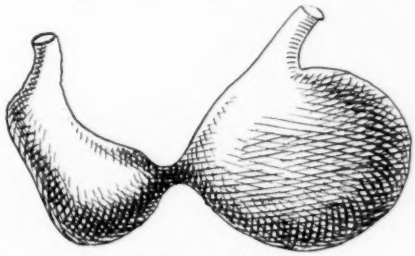


FIG. 5.—(From Eiselsberg.)

wards the lesser at the point of constriction. The only outward pathological change noticeable was a slight thickening extending from the point of narrowing to the gastrohepatic ligament. The stricture admitted a lead-pencil only. There were the scars of some small, old healed gastric ulcers which were not in connection with the constricted area. The walls of the cardiac portion of the stomach were thicker than those of the pyloric, the former

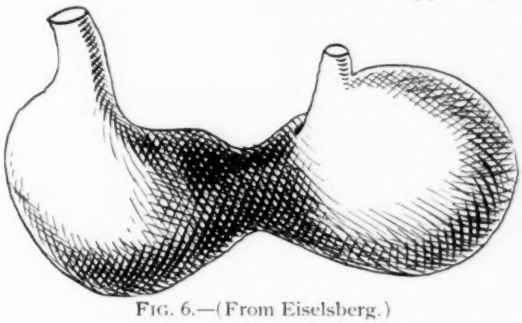


FIG. 6.—(From Eiselsberg.)

being between two and three centimetres and of the latter from one to two centimetres.

AN ANALYSIS OF THE ABOVE TWENTY CONGENITAL CASES.

Situation of the Stricture.—In the middle, 7; at the junction of the upper and middle thirds, 3; at the junction of the lower and middle thirds, 4; not noted, 6. Total, 20.

Size of Constriction.—Allowed the passage of a lead-pencil, 5; allowed the passage of the index-finger, 6; allowed the passage of the thumb, 2; allowed the passage of two or three fingers, 3; noted as narrow, 4. Total 20.

Age.—Noted in eight cases as twenty-five, forty-three, forty-five fifty-six, fifty-nine, sixty-three, sixty-seven, and seventy-three.

Sex.—Women, 7; men, 1; not noted, 12. Total, 20.

Symptoms noted in Connection with Congenital Cases.—In three they are stated to have been wholly absent; the constrictions were in all of these only large enough to allow the passage of one finger; and the ages were respectively forty-three, fifty-six, and sixty-three.

In only three other cases are symptoms referred to. The first is Hochenegg's (see table of operated cases, No. 20). In the two others there was vomiting and gastralgia, gradually increasing in severity, but extending over periods of fifty-one and twenty-three years in individuals who were sixty-seven and fifty-three years respectively. In both the constrictions admitted one finger only.

Acquired Forms.—Twenty cases in which no operation was performed.

(1) Steffan (*Glasgow Medical Journal*, April, 1868, Vol. ii, p. 126). The stomach was bound to the anterior abdominal wall by dense adhesions, through which a fistulous tract led to a perforating gastric ulcer; the abdominal wall was also perforated, thus establishing a gastro-abdominal fistula. The constriction was in the middle of the stomach and was impermeable. The stomach walls were much thickened.

(2) Finny (*British Medical Journal*, 1887, Vol. ii, p. 1157). A woman, aged thirty-seven. An hour-glass constriction of the middle of the stomach permitting the passage of two fingers. A gastrocolic fistula as in the last case, the fistulous tract leading through a mass of dense adhesions from the orifice in the abdominal wall to a perforating ulcer of the stomach. The constriction of the organ was due to the presence of these adhesions.

(3) Turner (*Transactions of the Pathological Society*, Lon-

don, Vol. xxxviii). A man, aged sixty. An old healed gastric ulcer on the anterior wall of the stomach, surrounded by extensive cicatrix and causing a constriction of the organ two inches above the pylorus. Constriction admitted a slate-pencil only.

(4) Kern (Inaugural Address, Berlin, 1891). A woman, aged fifty-eight, who had suffered for a long while from frequent vomiting. An hour-glass constriction from cicatrix of an old healed ulcer; the narrowing admitted the little finger only.

(5) Quain (*Transactions of the Pathological Society*, Vol. vii, p. 192). Simply reported by Hirsch as being an hour-glass contraction of the stomach due to the cicatrix of an old ulcer.

(6) Langerhans (*Virchows Archiv*, Band iii, date ?, etc. ?). A woman, aged forty-three. A mass of cicatricial bands in the middle of the lesser curvature and the posterior wall of the stomach producing an irregular constriction at that point. From there they extended over onto the pyloric end of the organ and the duodenum, which they had drawn over towards the middle of the lesser curvature so much as to cause a total occlusion of the lumen of the bowel, to which fact the woman's death was due. (Compare with Watson's case, No. 22, Table of Operated Cases).

(7) Sharkey (*Transactions of the Pathological Society*, London, 1884, Vol. xxxv). *Due to cancer.* A woman, aged sixty-five. A constriction admitting a slate-pencil only, was produced by a cancerous growth, which involved such an extensive area of the stomach that the lumen was nowhere larger than that of the small intestine.

(8) Robinson (*Transactions of the Pathological Society*, London, Vol. iv, p. 134). Hour-glass constriction caused by a strong band of adhesions between the lesser curvature of the stomach and the left lobe of the liver.

(9) Jago (*Medical Times and Gazette*, London, 1872, Vol. xi, p. 409). A woman, aged fifty-three, who had suffered since her thirtieth year from vomiting. In the latter years of her life she developed an enormous appetite, which Jago supposes to have been due to her not feeling nourished or satisfied from her food until the first compartment of the stomach had accumulated such a load as to produce enough tension of its walls to force some of its contents into the second half, from which it could pass on to be digested. The constriction was in the middle of the organ,

and admitted an index-finger only. There were close to its pyloric end the cicatrices of two old ulcers.

(10-18) Roger Williams (*op. cit.*). In these eight cases the constriction was in, or very nearly in, the middle of the stomach. The size of the constriction varied from that of a slate-pencil to being large enough to admit three fingers. There were pathological processes connected with the constricted area in all. These included gastric ulcer unhealed, the cicatrices of old ulcers, indurations, in one of which there was an infiltration of lime-salts.

(19) Siewers (*Berliner klinische Wochenschrift*, 1899, p. 15). A case in which there was a perforating ulcer situated directly in the constriction. (The specimen was considered by Siewers to be congenital.)

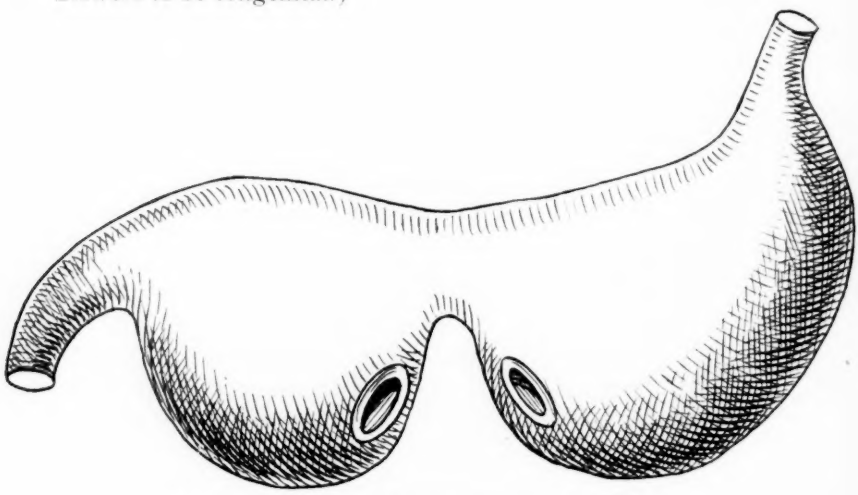


FIG. 7.—Communicating openings completed (Wölfler).

(20) Watson (reported for the first time). The specimen was found at autopsy of a woman of eighty years of age, who died in one of the public institutions of Boston. It is shown in Fig. 7. The constriction, which admitted the passage of the index-finger, is situated in the middle of the stomach. The only evidence of its being of the acquired form is the existence of a moderate amount of cicatricial tissue at the upper border of the constriction directly upon the lesser curvature, which had drawn the stomach together in such a way as to make it evident that the constriction was directly due to it. It resulted apparently from

an old ulcer which had healed at this point. The walls of both divisions of the stomach were thin and atrophied, as was also its mucous membrane. The two halves of the stomach were nearly equal in size though differing in shape.

Symptoms and Diagnosis.—In general, it can be said that the symptoms of this condition are the same as those seen in connection with benign stenosis of the pylorus. The number of cases of *congenital* nature in which the symptoms have been reported are too few to permit of any inferences being drawn from them to compare with those observed as occurring in the cases of the *acquired* form. It is, however, interesting to note that three individuals are stated to have been wholly free from all symptoms who lived to the ages of forty-three, fifty-six, and sixty-three, and who were the subjects of very narrow constrictions of congenital form. There is *no* example, on the other hand, among the acquired cases in which it is asserted that there had been no gastric symptoms, and this is what one would expect in the latter class, inasmuch as the large majority result from gastric ulcer, and the remainder are seen in association with conditions whose course is almost certain to be marked by well defined symptoms.

It is striking how long many of the patients have been able to support life, having, in some instances, extreme examples of the hour-glass constrictions.

With regard to the diagnosis as distinctive from that of stenosis of the *pylorus*, there are some few things to be said. The observation made by Wölfler in his case noted at times that fluid injected into the stomach, instead of returning through the irrigating tube, seemed to suddenly disappear, as though it had flowed through a large hole. His suggestion being that it had passed through into the second division, where the end of the tube lying in the first part did not reach it.

Another fact noted by Wölfler was that on certain other occasions, when the stomach had apparently been washed quite clean, there would suddenly be returned through the tube a quantity of partially digested food; this had presumably been

regurgitated from the second half of the stomach back into the first, and so gained access to the end of the tube there.

Eiselsberg adds another observation which may be of service sometimes in making the diagnosis of this condition. He noted in one of his cases that when he injected a quantity of fluid into the stomach, the left side of the epigastrium became distended, and then a moment or two later this swelling partially subsided, while at the same moment there appeared an enlargement of the right side of the epigastrium, these changes being accompanied by a gurgling sound such as is made by air and liquid being forced through a narrow channel.

Bouveret and others have been enabled to make the diagnosis by means of insufflation of the stomach. (Those interested in this procedure, which does not appeal to the writer as being a desirable or necessary thing to do in cases of this sort, are referred to Bouveret's article, *Lyon Medical,* Vol. lxxxi, 1896, p. 143.)

There is one other diagnostic step which is of some interest, suggested and carried out experimentally by Roux and Balthazard and published in the " Mémoires de la Société de Biologie," 1897, pp. 785, under the title of " Étude des contractions de l'estomac chez l'homme a l'aide des rayons de Röntgen."

In this they note the possibility of studying the movements of the stomach by rendering it opaque to the X-rays by means of mixing a quantity of subnitrate of bismuth with water, or food of a sort that will allow a thorough mixture of the two substances, and then observing the movements and changes of form which appear on the examination with the fluoroscope. They used for this purpose in the human subject fifteen to twenty grammes of bismuth to 100 grammes of water. Their conclusions do not bear directly upon the subject here under consideration, and are therefore not quoted, but the application of their methods to the diagnosis of this condition might be of some value. In one case (that reported as No. 11 in the table of operated cases) Burney Yeo made the diagnosis by hearing—frequently repeated and always at the same spot—

a gurgling sound in the middle of the stomach, such as that which is made by fluid forced through a narrow passage.

Finally, attention has been called to the persistence of the splashing sound on succussion after lavage.

While such diagnostic measures as frequently repeated irrigations and insufflations are no doubt interesting to the physician, they seem to the writer to be of doubtful utility to the patient. They are not positive; they may in some instances be attended with danger, for example, when performed in the presence of an open and thin walled ulcer; and, finally, symptoms of stenosis existing somewhere between the cardiac end of the stomach and the first part of the duodenum being well marked in these cases, an exploratory laparotomy will practically always be indicated; and inasmuch as no special preparation for operations for the relief of hour-glass constriction is required other than that which would be called for in other stenoses, it is not essential to know beforehand the precise position of the constriction, and the need of subjecting an already sufficiently suffering patient to such annoying or painful procedures is not obvious.

In the following analysis of acquired cases, twenty in which no operations were performed are included, together with the thirty-five operated cases which are tabulated further on, making fifty-five in all.

Cause of Constriction.—Cicatrices of old ulcers, 20 cases; cicatrices (ulcer not mentioned in connection with), 8 cases; perforating ulcer and cicatrices (in two of these there was a gastric fistula perforating the abdominal wall), 9 cases; unhealed gastric ulcer noted in connection with, 5 cases; adhesions between the stomach and neighboring organs (usually associated with old gastric ulcer), 9 cases; due to involvement by cancerous disease originating outside the stomach, 1 case; following the ingestion of hydrochloric acid, 1 case; due to adhesions originating in inflammatory peritoneal processes not primarily in the stomach, 2. Total, 55 cases.

Position of Constriction.—In the middle of the stomach, 20 cases; at or below the junction of middle and lower thirds,

10 cases; at or above junction of middle and upper thirds, 6 cases; not noted, 19 cases. Total, 55 cases.

Degree of Narrowing.—In one case in which there was a gastric fistula from a perforating gastric ulcer which had penetrated the abdominal wall, the constriction was impermeable.

In two others rotation of one-half of the stomach on the constricted part was noted; in these temporary occlusion of the stomach lumen occurred. In all the rest, in which the calibre of the strictured part was noted, it varied from the size of a crow's quill to that of three fingers, the larger number permitting the passage of one finger.

Sex.—Women, 34 cases; men, 3 cases; not noted, 18 cases. Total, 55 cases.

Age.—Youngest, 22 years; oldest, 80 years. Between 20 and 30, 5 cases; between 30 and 40, 10 cases; between 40 and 50, 8 cases; between 50 and 60, 12 cases; over 60 (one 73 and one 80), 2 cases; not noted, 18 cases. Total, 55 cases.

Symptoms noted in Connection with Acquired Cases.—Duration of symptoms. Noted in 18 cases as follows: 3 years, 5 years, 7 years, 9 years, 11 years, 12 years, 13 years, 14 years, 16 years, 16 years, 17 years, 23 years, 28 years. Noted as many years in 5 cases.

Vomiting (provoked by food in all but two of the 18 cases below) frequent in 12 cases, occasional in 6 cases. Total, 18 cases.

Hæmatemesis present in 13 cases, absent in 7 cases. Total, 20 cases.

Free hydrochloric acid noted as present in 5 cases.

Gastric pain present in 16 cases.

Marked loss of weight in 18 cases.

Dilatation of the stomach present in 6 cases; absent in 8 cases; not noted in 9 cases. Total, 23 cases.

Tumor to be felt in 6 cases; stated to be absent in 7 cases. Total, 13 cases.

Jaundice was noted in connection with 2 cases; constipation was noted in connection with 3 cases.

From the above analysis the following general conclusions may be stated. With three exceptions the patients were women. Of thirty-seven individuals whose ages are noted, fourteen had lived to be over fifty years old, and in none of these had symptoms been present for less than three years.

Vomiting is the most constant symptom, and almost always follows at once or very soon after taking food. It is often of the most distressing character. The loss of weight is almost invariable; but it is noteworthy how long vomiting and gastric pain may continue before the impairment of nutrition begins to be marked, and also how rapid the loss of weight is, once it has begun.

Hæmatemesis did not occur in any case in which gastric ulcer had not existed.

Free hydrochloric acid is probably present in most cases, but is definitely stated to have been absent in one.

Gastric pain is, next to vomiting, the most frequent symptom, is sometimes constant, often very severe, and is almost always provoked by food. It is not necessarily dependent upon the presence of *unhealed* ulcer, but is sometimes associated with adhesions and old cicatrices, and may be referable to them as much as to the hour-glass contraction itself, this being suggested by its occurrence in cases of adhesions involving the stomach in which there is no hour-glass deformity, and also by the few examples of entire absence of pain as well as all other symptoms in the three congenital cases in which there were very narrow constrictions in hour-glass stomachs.

The *cardiac division* of the stomach is usually *dilated*, and often also the pyloric, that of the latter being explained perhaps by large gas formation that is due to retention and decomposition of the ingesta occurring primarily in the cardiac division. In the larger number of the cases in which it is noted at all, the walls of the cardiac portion were somewhat atrophied, and thinner than those of the pyloric; in a few instances the reverse is the case. In the example reported by the writer as No. 19 of the congenital cases, the walls of the pyloric part of the stomach were greatly thickened both as

compared with their normal condition and also relatively to the walls of the cardiac portion; and the same is reported to have been observed in one other case. In the writer's there was no means of knowing what, if any, pathological changes may have been present in the intestine or other organ adjacent to the pylorus and outside the stomach to which this hypertrophy of the muscular structure of the pyloric half might have been due, and he can offer no plausible explanation of its existence. There is likewise no suggestion as to its causation in the other case reported.

A tumor or sense of increased resistance was observed in six cases, in all of which extensive adhesions or cicatrices were present.

The constriction is situated in the middle of the stomach in the majority of cases, and in much the largest number of the acquired forms it is due to gastric ulcer. It is indeed rather surprising that more cases of gastric ulcer do not eventuate in hour-glass constrictions, for a study of specimens of the latter deformity in the instances in which it was due to the cicatrices of old ulcers shows that it can be, and often is, produced by cicatrices of relatively slight extent which do not involve the whole or even the larger part of the circumference of the organ, nor do they occupy a large area of its surface.

TABLE OF TWENTY-NINE OPERATIVE CASES OF HOUR-GLASS STOMACH.

No. 1.—*Operator, date, and publication,* Bardleben, 1889. Female, *Method of operation,* gastroplastic. *Result and subsequent observations,* recovery. Relief of symptoms.

No. 2.—*Operator, date, and publication,* Kruckenberg, 1892, November 3, Münchener medicinische Wochenschrift, May, 1893, No. 19, p. 358. Thirty-three years. Female. *Symptoms and condition of patient,* gastric symptoms gradually increasing in severity. For nine months pain after food only, for three months constant; nine months, daily vomiting. Hæmatemesis frequently for six months. Marked loss of weight and strength. Present weight ninety pounds. There is an area of dull percussion and increased resistance in right epigastrium. *Pathological condition found at time of operation,* thickened, indurated area on the anterior surface due to gastric ulcer. A small unhealed ulcer at the point of constriction. *Method of operation,* gastroplastic. Excision of ulcer.

Result and subsequent observations, recovery. Entire relief of symptoms. Gain in weight of twenty-one pounds in the first three months after operation.

No. 3.—*Operator, date, and publication,* Zeller, 1893, Centralblatt für Chirurgie, 1894, p. 355. *Pathological condition found at time of operation,* hour-glass stomach, constriction due to an old cicatrix of a healed ulcer. *Method of operation,* resection of constricted portion. *Result and subsequent observations,* death. Due to septic peritonitis caused by perforation of a fresh ulcer.

No. 4.—*Operator, date, and publication,* Wölfler, May, 1894, Beiträge für klinische Chirurgie, 1895, No. 13, Heft 1, p. 221. Thirty-six years. Female. *Symptoms and condition of patient,* fourteen years previous, an acute gastric attack, vomiting, epigastric pain, tympanites. Symptoms became mild after a short time, but continued ever since. For two years past pain provoked by food, and occasional vomiting, loss of weight. No hæmatemesis. *Pathological condition found at time of operation,* stomach divided equally, by cicatrix of an old ulcer, in middle of stomach. Constriction is size of the thumb. Cicatrix at the middle of the lesser curvature, and involves the gastrohepatic ligament, and the pancreas. *Method of operation,* gastro-anastomosis. *Result and subsequent observations,* recovery. At end of three months patient was entirely free of all symptoms and had gained nine kilogrammes in weight.

No. 5.—*Operator, date, and publication,* Eiselsberg, October, 1894, Langenbeck's Archives, Band 1, p. 4. Twenty-eight years. Female. *Symptoms and condition of patient,* symptoms of gastric stenosis. Hæmatemesis. Tumor to be felt in the epigastrium. *Pathological condition found at time of operation,* constriction in middle due to cicatrix of old ulcer. It involves nearly the whole circumference of the organ and a part of the pancreas. *Method of operation,* gastro-anastomosis. *Result and subsequent observations,* death on second day through giving way of sutures which had been in one place set in the indurated area. Septic peritonitis resulted.

No. 6.—*Operator, date, and publication,* Watson, F. S., September 13, 1895, Boston Medical and Surgical Journal, April 2, 1896. Thirty-two years. Female. *Symptoms and condition of patient,* seven years previous, epigastric pain. Vomiting, hæmatemesis, jaundice. Soon recovered; was well for two years. Then symptoms returned, but were less severe, up to three years ago, since then progressively worse. Daily vomiting for one year. Pain provoked by food, constant for three years. Loss of weight in past year forty pounds; present weight, eighty-six pounds. Constipation. An ill-defined tumor in left epigastrium. *Pathological condition found at time of operation,* constriction at junction of middle and lower thirds of the stomach. Cardiac portion much dilated, pyloric normal in appearance. Constriction size of little finger, due to cicatrix of old ulcer, and involving whole circumference of the organ. *Method of operation,* gastro-anastomosis. *Result and subsequent observations,* recovery with entire relief of all symptoms; gain in weight of forty-two pounds in the first six months. The patient was seen from time to time for the next *four and a half years.*

She remained well up to that time, was entirely free from all symptoms. The only change being the loss of fourteen pounds' weight of the forty-two which she gained at first, which was owing to hard work and less good surroundings than she had had at first.

No. 7.—*Operator, date, and publication,* Lauenstein, 1895, December 24, Münchener medicinische Wochenschrift, 1896, No. 43, p. 49, May. Forty-three years. Female. *Symptoms and condition of patient,* began thirteen years ago. Short attacks of jaundice, gastric pain, occasional vomiting, and hæmatemesis. Severe since three years; one year constipation. Food taken three days before sometimes seen in vomitus. Recently daily vomiting, once copious hæmatemesis. Free hydrochloric acid in gastric juice. No tumor. Great loss of weight; present weight eighty-seven pounds. *Pathological condition found at time of operation,* constriction in the middle, from it firm adhesions to the liver. Constriction very narrow, due to cicatrix near lesser curvature and near its centre. *Method of operation,* gastro-anastomosis. *Result and subsequent observations,* recovery. Symptoms were relieved; gain in weight in the first three months was thirty-five pounds.

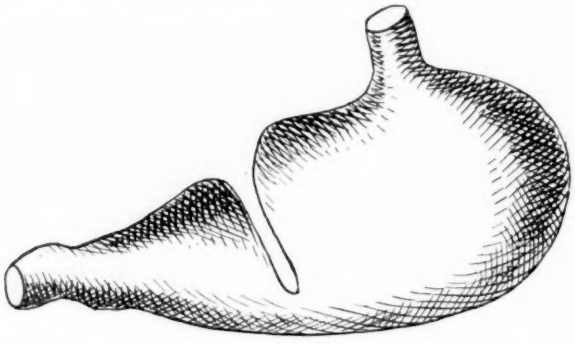


FIG. 8.—Table of operated cases, No. 8 (Schwarz).

No. 8.—*Operator, date, and publication,* Schwarz, 1896, January 3, Wiener klinische Wochenschrift, June, 1896, p. 548. Thirty years. Female. *Symptoms and condition of patient,* five years. Gastralgia, vomiting, hæmatemesis, pain. Progressively worse; loss of weight now thirty-eight kilogrammes. Hydrochloric acid absent. *Pathological condition found at time of operation,* constriction near the middle, due to adhesions extending from point of narrowing to diaphragm, liver, and omentum, and involving the stomach. The lesser was drawn *down* to the greater (Fig. 8). *Method of operation,* gastro-anastomosis, subsequent gastrolysis. *Result and subsequent observations,* recovery. Symptoms not relieved by the first operation, were greatly improved by the second one, and entire relief by inflations (daily) of the stomach for some time after the second operation. Gain in weight at end of twenty-one months was twelve kilogrammes.

No. 9.—*Operator,* Eiselsberg. Forty-nine years. Female. *Symp-*

toms and condition of patient, gastric symptoms from childhood. Now intense pain after food, stomach dilated. *Pathological condition found at time of operation*, large ulcer near the fundus (unhealed), from it adhesions attaching stomach to abdominal wall. Constriction nearly in middle of organ. *Method of operation*, gastroplastic. *Result and subsequent observations*, recovery. Relief of symptoms for nine months, then recurrence.

No. 10.—*Operator, date, and publication*, Jaboulay, July 17, 1895, Archives provinciales de chirurgie, 5, 1896, p. 641. Forty-one years. Female. *Symptoms and condition of patient*, vomiting since twelfth year; first attack lasted two months, thereafter well for six years; at twentieth year gastralgia, provoked by food. At age of twenty-eight, during third pregnancy, very frequent vomiting, and more or less vomiting and gastralgia since. During past year severe gastric symptoms, intense gastric pain, distention sometimes appearing as a large tumor in the epigastrium. Very frequent vomiting; vomitus sometimes contained bits of food swal-

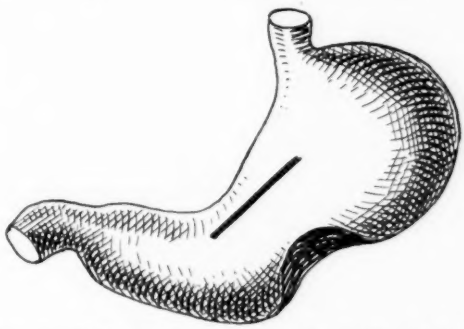


FIG. 9.—Table of operated cases, No. 9 (Eiselsberg).

lowed two or three days before. Great loss of weight and strength. No tumor to be felt. Free hydrochloric acid in gastric juice. *Pathological condition found at time of operation*, constriction very narrow, in the pyloric third of the stomach; both compartments dilated, and walls atrophied. Torsion of the lower part of the organ upon the constriction causing total occlusion of the lumen of the latter at times; greater curvature drawn up to the lesser at point of constriction. Cicatrix resulting from an old ulcer near the lesser curvature and causing the constriction; also firm adhesions from the constricted part to the left lobe of the liver. *Method of operation*, gastroplastic. *Result and subsequent observations*, recovery. Relief of symptoms; case followed for one year, at which time gain in weight had been sixteen kilogrammes, and the patient's condition remained satisfactory.

No. 11.—*Operator, date, and publication*, Watson Cheyne, December 1, 1897, London Lancet, 1898, March, p. 785. Forty-six years. Female. *Symptoms and condition of patient*, symptoms began in 1881, and have been present more or less constantly ever since. Gastric pain, frequent vomiting (no hæmatemesis), loss of weight (present weight eighty-eight pounds)

and strength. Moderate dilatation of stomach most marked over cardiac end. *Pathological condition found at time of operation,* constriction in the middle of the stomach. The constriction permitted the passage of a crow-quill only. Both parts of the stomach dilated, the cardiac end more than the pyloric. Total atrophy of the mucous membrane in the constricted part, much cicatricial tissue around the constricted portion.

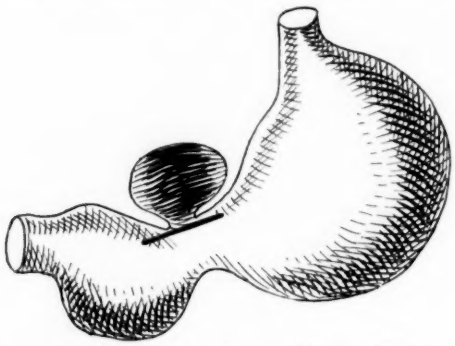


FIG. 10.—Table of operated cases, No. 12 (Eiselsberg).

Method of operation, gastroplastic. *Result and subsequent observations,* recovery. Fed by enemata for four days, by mouth liquid diet until fourteenth day, then solid food, gain in weight at end of fifth week was eight pounds; last note at end of three and one-half months patient in good health and free from symptoms.

No. 12.—*Operator, date, and publication,* Eiselsberg. The following six cases were between January, 1898, and June, 1899, Archiv für klin-

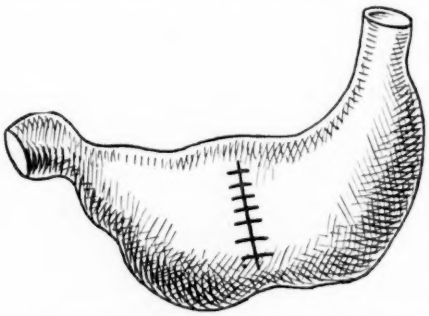


FIG. 11.—Table of operated cases, No. 12 (Eiselsberg).

ische Chirurgie, 1899, Band lix, Heft 4. (See Figs. 10-16.) Thirty-four years. Female. *Symptoms and condition of patient,* sixteen years prior had hæmatemesis, pain in epigastrium. Symptoms not severe until a few weeks ago, then intense gastralgia and repeated hæmatemesis. In middle of epigastrium, a hard, tender tumor, which is adherent to abdominal wall. *Pathological condition found at time of operation,* constriction admitting

little finger only, situated in the pyloric third of the organ, and due to cicatrix of ulcer, which drew the greater towards the lesser curvature, and also attached the stomach to the liver and pancreas. Immediately above the constriction, an abscess, size of a hen's egg, surrounded by adhesions, and having a perforating gastric ulcer at its bottom, which perforation was situated exactly at the constricted portion. *Method of operation,* gastro-

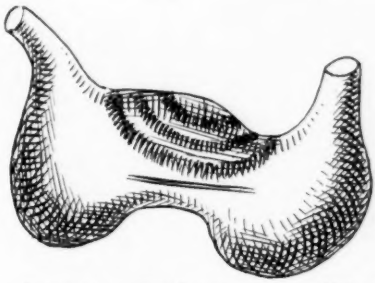


FIG. 12.—Table of operated cases, No. 13 (Eiselsberg).

plastic separation of adhesions. Incision was carried directly through the ulcer. *Result and subsequent observations,* death, ten hours after the operation.

No. 13.—*Operator, date, and publication,* Eiselsberg, op. cit. Thirty-six years. Female. *Symptoms and condition of patient,* for seventeen years symptoms of gastric ulcer. For six months at time hæmatemesis, gastric pain, vomiting, loss of weight. An area (tender to touch) of in-

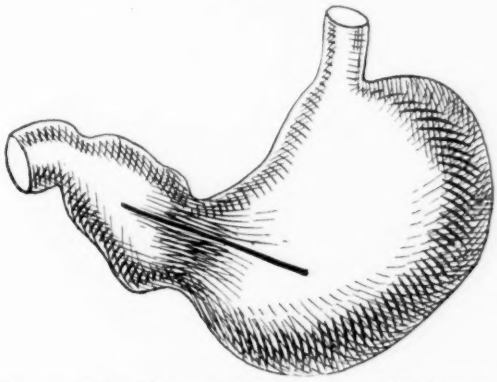


FIG. 13—Table of operated cases, No. 14 (Eiselsberg).

creased resistance to the left of umbilicus. *Pathological condition found at time of operation,* constriction in the middle of stomach, due to adhesions which bound it to the posterior abdominal wall and to the liver. The adhesions made a mass as large as the fist, which occupied the middle of the lesser curvature, in a crescentic form. On the posterior wall on the inner surface was a very large open ulcer which had eaten through

the stomach and eroded the pancreas which formed its bottom. *Method of operation,* gastroplastic; adhesions separated with difficulty. Liver slightly torn in so doing. Jejunostomy, method of Witzel, also done at same time. *Result and subsequent observations,* death, twelve hours after the operation.

No. 14.—*Operator, date, and publication,* Eiselsberg, op. cit. Thirty-

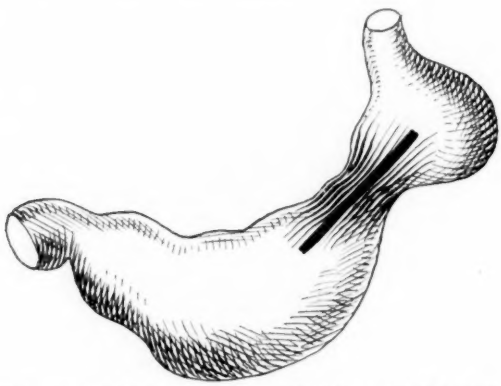


FIG. 14.—Table of operated cases, No. 15 (Eiselsberg).

three years. Female. *Symptoms and condition of patient,* for many years suffered from gastric symptoms. No tumor. After washing the stomach, and when fluid has ceased to return through the tube, on withdrawing it somewhat, there is a sudden flow of the irrigating fluid again. *Pathological condition found at time of operation,* constriction admitting little finger

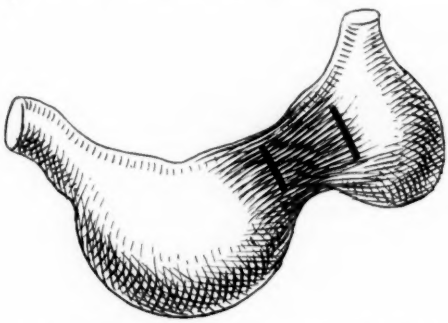


FIG. 15.—Table of operated cases, No. 15, second operation (Eiselsberg).

in the pyloric third of the stomach. *Method of operation,* gastroplastic; subsequently, about one year later, a second operation. Gastro-enterostomy on account of recurrence of symptoms. *Result and subsequent observations,* recovery from both operations. There was relief of all symptoms for nine months after the gastroplastic: then recurrence; relief followed second operation also.

No. 15.—*Operator, date, and publication,* Eiselsberg, op. cit. Thirty-years. Female. *Symptoms and condition of patient,* gastric symptoms for many years, occasional hæmatemesis, of late increasing in severity. No tumor. With injection of water, the right half of the stomach could be seen to fill first and then the left. Free hydrochloric acid present. After taking food, if the stomach was washed out until the irrigating fluid returned clear, there would suddenly, after a few moments, flow a quantity of old partly digested food through the tube. The diagnosis of hour-glass stomach was made on these two signs. *Pathological condition found at time of operation,* circular constriction nearer the cardia than pylorus. Cardiac division of the stomach smaller than the pyloric. Constriction size of the thumb. *Method of operation,* three operations: two gastroplastic and then gastro-anastomosis. *Result and subsequent observations,* recovery from all three operations, but recurrence of symptoms after all of them, the intervals being four months, nine months, and two months.

No. 16.—*Operator, date, and publication,* Eiselsberg, op. cit. Thirty-two years. Female. *Symptoms and condition of patient,* severe gastric pain, frequent vomiting and hæmatemesis. For the last three months

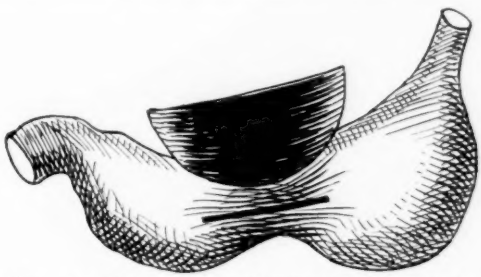


FIG. 16.—Table of operated cases, No. 16 (Eiselsberg).

could retain scarcely anything, great loss of weight. No tumor, but marked dilatation. Much free hydrochloric acid. *Pathological condition found at time of operation,* constriction admitting the passage of one finger due to circular cicatrix and adhesions which bound the stomach, at and about the point of constriction, to the liver. *Method of operation,* gastroplastic. *Result and subsequent observations,* recovery, with entire relief of all symptoms.

No. 17.—*Operator, date, and publication,* Eiselsberg, op. cit. Forty-three years. Female. *Symptoms and condition of patient,* since her twentieth year suffered from dyspeptic symptoms. For about one year almost daily vomiting, but several hours after taking food. Noticed a hard tumor some few months ago under the border of the ribs on the left side. In last nine months has lost twenty-seven pounds. Free hydrochloric acid. A hard movable tumor in the region of the pylorus. *Pathological condition found at time of operation,* circular constriction nearer the cardiac than the pyloric end of the stomach, and also a dense mass of adhesions from the constricted portion of the stomach to the liver, the whole being apparently due to an old ulcer at the same part of the organ.

The dense adhesions and cicatrix gave rise to the tumor which had been felt. *Method of operation,* gastro-enterostomy. *Result and subsequent observations,* recovery. Solid food after the first week; gained in eighteen days two kilogrammes, and was discharged entirely free from symptoms at that time.

No. 18.—*Operator, date, and publication,* Von Unge, 1898, Centralblatt für die Grenzgebiete der Medicin und Chirurgie, May 1, 1899, p. 379. Twenty-two years. Female. *Symptoms and condition of patient,* for several years, gastric pain, hæmatemesis, loss of weight and strength. *Pathological condition found at time of operation,* a circular constriction admitting the forefinger only, eight centimetres from the pylorus. *Method of operation,* gastroplastic. *Result,* recovery.

No. 19.—*Operator, date, and publication,* Von Unge, op. cit. Fifty-three years. Female. *Symptoms and condition of patient,* for several years gastric pain and occasional hæmatemesis recently. A tumor of the size of a hen's egg is to be felt to the right of the umbilicus. *Pathological condition found at time of operation,* constriction admitting the forefinger ten centimetres from the pylorus. The tumor was a mass of adhesions between the constricted part of the stomach and the gall-bladder. *Method of operation,* gastroplastic. *Result,* recovery.

No. 20.—*Operator, date, and publication,* Hochenegg, February 23, 1898, Wiener klinische Wochenschrift, May, 1898, p. 514. Twenty-five years. Male. *Symptoms and condition of patient,* vomiting for many years, but no impairment of health until fifteenth year, then vomiting became more frequent: it was always provoked by food. Epigastric pain and sense of oppression. Marked remissions. Vomitus sometimes contained bits of food which had been swallowed two or three days before. Great thirst. Loss of weight in the last three years has been twenty-six kilogrammes. Stomach greatly distended. Splashing sound and tympanitic resonance over the whole abdomen when the patient is standing up. No area of induration or tumor to be felt after the stomach has been washed out. *Pathological condition found at time of operation,* constriction one-third of the distance above the pylorus, admitting little finger. Cardiac part of stomach enormously dilated; the pyloric part also distended with gas. The walls of both parts atrophied. No pathological processes present. Congenital hour-glass stomach. *Method of operation,* gastro-anastomosis. *Result and subsequent observations,* recovery. Patient took liquid food by mouth from first.

No. 21.—*Operator, date, and publication,* Mayo Robson, 1899, Lancet, March 10, 1900, p. 681. Forty-five years. Female. *Symptoms and condition of patient,* nine years ago an attack lasting three weeks, severe pain in right hypochondrium, vomiting provoked by food, pain not relieved by vomiting. Slight swelling in epigastrium. Well for three years, then second attack lasting one month, same as first, except pain in left hypochondrium. Seven months ago third attack, same symptoms; since then pain has been constant and vomiting frequent, and the abdomen has been somewhat distended. No tumor. *Pathological condition found at time of operation,* stomach adherent to the anterior abdominal wall by a mass

of adhesions, which, being divided, exposed a gastric fistula leading into the stomach through a constriction which divided it into two compartments, making an hour-glass form. The perforation originated in a gastric ulcer at the point of narrowing, which would not permit the passage of one finger; there was also the cicatrix of another old ulcer at the lesser curvature. *Method of operation,* gastroplastic. The incision was carried through the open ulcer from which the fistula proceeded. *Result and subsequent observations,* recovery. Relieved of all former symptoms, gained about twelve pounds in weight in a little over two months after the operation.

No. 22.—*Operator, date, and publication,* Watson, F. S., not published before. Case operated at Boston City Hospital, February 8, 1900. Thirty-five years. Female. *Symptoms and condition of patient,* first symptoms, eleven years ago, hæmatemesis, which has been repeated occasionally ever since; hæmorrhage never severe. There has been more or less burning, gastric pain and epigastric tenderness from the first. Appetite has remained fairly good, and strength and weight have been maintained up to the last year, since which time she has lost both, and the other symptoms have increased in severity. February 8, while walking, sudden violent pain beneath the border of the ribs on the left side, and violent vomiting. At time of operation, temperature 99.5° F.; pulse, 110. Abdomen rigid and tympanitic. Liver dulness, but slightly diminished. Respiration shallow, thoracic, and rapid. General abdominal tenderness most marked in upper part of abdomen. *Pathological condition found at time of operation,* a dense mass of adhesions united the portion of the stomach at junction of the central and lower third of the lesser curvature to the anterior abdominal wall, while a second offshoot of adhesions attached it firmly to the edge and under surface of the left lobe of the liver and, extending downwards, involved the pancreas as well. The pyloric end of the organ and the first two inches of the duodenum were also included in these adhesions, and, as a consequence, were curled upward and backward and firmly united to the lesser curvature at the junction of its middle and lower thirds. The whole of the above described tissues were welded into a thick mass nearly as large as the closed fist. On separating the adhesions from the abdominal wall in front, a pus cavity leading to a perforating gastric ulcer on the front of the stomach, close to its lesser curvature at the beginning of the lower third of its course, was opened. Ulcer size of the tip of the little finger, surrounded by dense infiltrated tissue. Stomach contents issued from the ulcer. An hour-glass constriction (not recognized at the time on account of its being masked by the mass of adhesions) at junction of middle and lower thirds of organ. The greater curvature was drawn upward to the lesser at constriction. Strictured part admits one finger. Cardiac part of organ larger than pyloric, both somewhat atrophied. (See Fig. 17.) *Method of operation,* ulcer inverted and sutured. All adhesions divided and stomach freed from its adherence to neighboring structures, except pancreas. *Result and subsequent observations,* death. The patient did perfectly well for the first two and a half days, then developed signs of general septic peritonitis, and died at the end of the fourth day. The stomach was secured post-mortem, and showed the condition described. The constriction was not recognized at

the time of the operation, and may have been—not being relieved—one of the elements in the fatal result, although the sutures had held, and there was a mild degree of disseminated peritonitis already present at the time of operation, due to leaking of the stomach contents from the perforation through an opening in the adhesions, stomach contents in small quantities being found in both flanks and as far down in the abdominal cavity as the pelvis, patches of peritonitis being associated with its presence.

The following cases were not accessible to the writer at the time of the first draft of his paper, and are therefore not placed correctly in their chronological order.

No. 23.—*Operator and date,* Doyen, 1893, Traitement chir. des affections de l'estomac, Paris, 1895. *Pathological condition,* a congenital hour-glass stomach, a perforating ulcer in the pyloric division of the stomach.

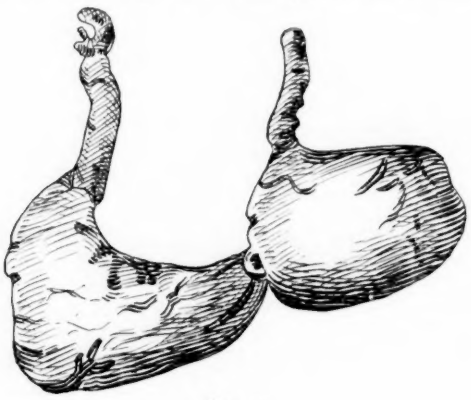


FIG. 17.

Stomach adherent to the anterior abdominal wall. *Operation,* inversion of ulcer, gastroplastic. *Result,* perfect recovery.

No. 24.—*Operator and date,* Langenbuch, 1896, Berliner klinische Wochenschrift, 1896, p. 855. Forty-three years. Female. *Pathological condition.* hour-glass stomach. *Operation,* gastroplastic. *Result,* recovery without relief of symptoms.

No. 25.—*Operator and date,* Von Noorden, 1896, Münchener medicinische Wochenschrift, 1896, p. 817. Twenty-five years. Female. *Pathological condition,* perforation of hour-glass stomach by ulcer, peritonitis. *Operation,* establishment of fistula. *Result,* death on fifty-sixth day.

No. 26.—*Operator and date,* Hofmeister, 1896, Beiträge zur klinische Chirurgie, Vol. xv, 1896, p. 351. Thirty-four years. Female. *Pathological condition,* hour-glass stomach from ulcer and cicatrices. *Operation,* excision of ulcer and gastroplastic. *Result, recovery.*

No. 27.—*Operator and date,* Courmont. *Pathological condition,* hour-glass stomach. *Operation,* gastroplastic. *Result,* recovery.

No. 28.—*Operator and date,* Cumston, C. G. (Boston), December, 1898, New York Medical Journal, 1899, December 9, p. 237. Forty-seven years. Female. *Pathological condition,* adhesions to surrounding structures from site of constriction. Constriction at junction middle and lower thirds of stomach admitting three fingers. No active ulcerative process. *Operation,* gastroplastic. *Result,* recovery three months after; gain of six pounds in weight in six months, after operation was free from all symptoms.

No. 29.—*Operator and date,* Klein, February 4, 1900. Wiener klinische Rundschau. A case of hour-glass stomach resulting from corrosion of hydrochloric acid. Male. *Pathological condition,* the patient drank strong hydrochloric acid into which sulphur matches had been thrown. *Operation,* gastroduodenostomy two months after the swallowing of the acid. *Result,* recovery with entire relief.

Summary of Operated Cases.—Total number of cases, 29; total number of deaths, 7.

Gastro-enterostomy, 3 cases; gastroplastic, 17 cases, 3 deaths; resection of constriction, 1 case, 1 death; gastro-anastomosis, 6 cases, 1 death; inversion of ulcer, 1 case, 1 death; establishing gastric fistula, 1 case, 1 death. Total, 29 cases and 7 deaths.

[NOTE.—Six cases—those of Nissen, Bauermeister, one each, and four of Bier's, referred to in Eiselsberg's article (*op. cit.*) are not included in these tables. The latter were not accessible to the writer, the two others did not involve operations on the stomach itself. References to all of them are in the bibliographical list appended to this article. There was but one death in these last six cases, so that the mortality ratio should be stated as being eight in a total of thirty-five.]

The Surgery of the Hour-Glass Stomach.—Surgically speaking, the hour-glass stomach has only existed in the last decade, and begins with the case of Kruckenberg in 1892, in which he performed gastroplasty, applying to the hour-glass stomach the Heinecke-Mikulicz method of doing pyloroplasty. The second and third operations were done by Zeller and by Doyen, being resection of the constriction and pyloroplasty together with inversion and suture of a perforating ulcer, re-

spectively. Of these three, Zeller's patient died and Kruckenberg's and Doyen's lived and were relieved of symptoms.

In 1894 Wölfler added new interest to the subject by adapting the principles of intestinal anastomosis to this condition for the first time; his procedure consisting in the establishment of an anastomosis between the two divisions of the stomach which lay one on either side of the hour-glass constriction. This was in May, 1894. In October of the same year Eiselsberg repeated Wölfler's experience, both cases being published in 1895. In September, 1895, the writer did the third gastro-anastomosis, but by a different method than that employed by either Wölfler or Eiselsberg, and having no knowledge of their cases at the time of his operation.

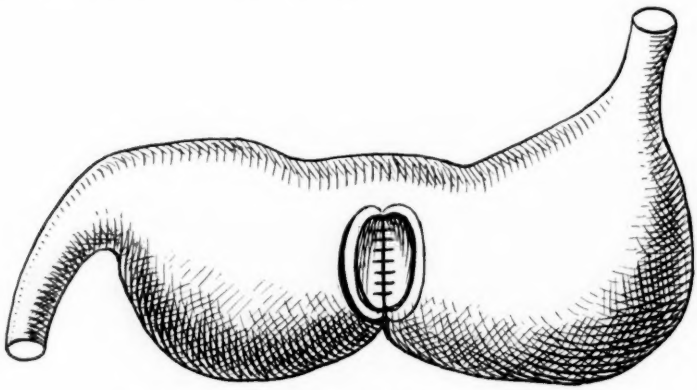


FIG. 18.—Their posterior margins united (Wölfler).

Of these first three gastro-anastomoses, Eiselsberg's died, Wölfler's and the writer's recovered, and were entirely relieved of symptoms.

Since then the number of operations has increased more rapidly, and there have been recorded up to the present time thirty-five altogether, the larger number of them having been done since 1896.

Technical Considerations.—There is no need to speak of the technique of the operation of gastroplasty, gastro-enterostomy, or resection of the constriction, since there is nothing in their application to the hour-glass stomach that differs from

that in the other conditions in which they are ordinarily employed, therefore only Wölfler's and the writer's methods of

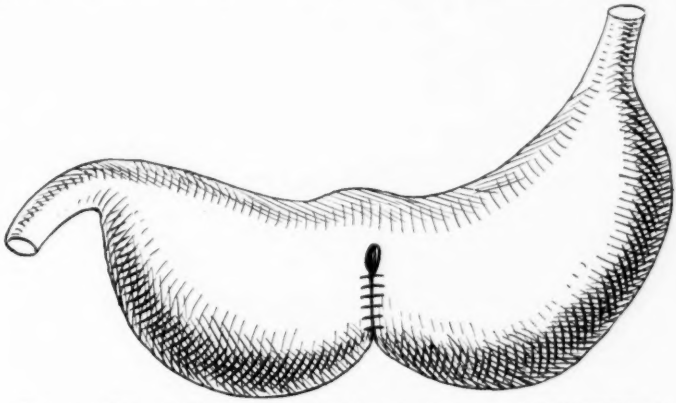


FIG. 19.—Suture of the communicating openings completed (Wölfler).

performing gastro-anastomosis will be described. Wölfler's operation was done as follows: The abdomen was opened by

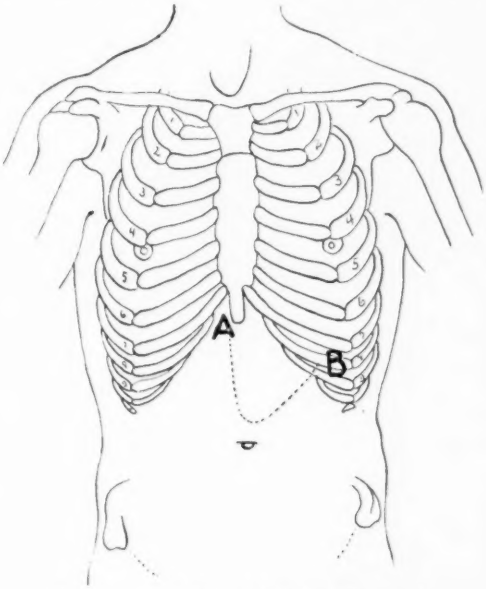


FIG. 20.—A, B, line of incision (Watson).

a median incision extending from the tip of the xiphoid cartilage to a point three centimetres below the umbilicus; an

hour-glass stomach was exposed, both divisions of which were dilated; while the constriction, which was in the middle of the organ, was bound to the pancreas and the gastrohepatic

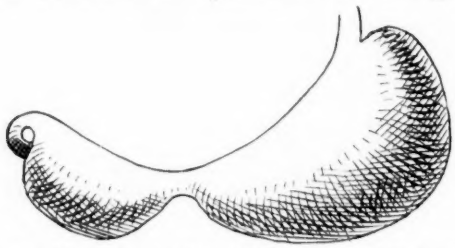


FIG. 21.—Shows the position of the stricture (Watson).

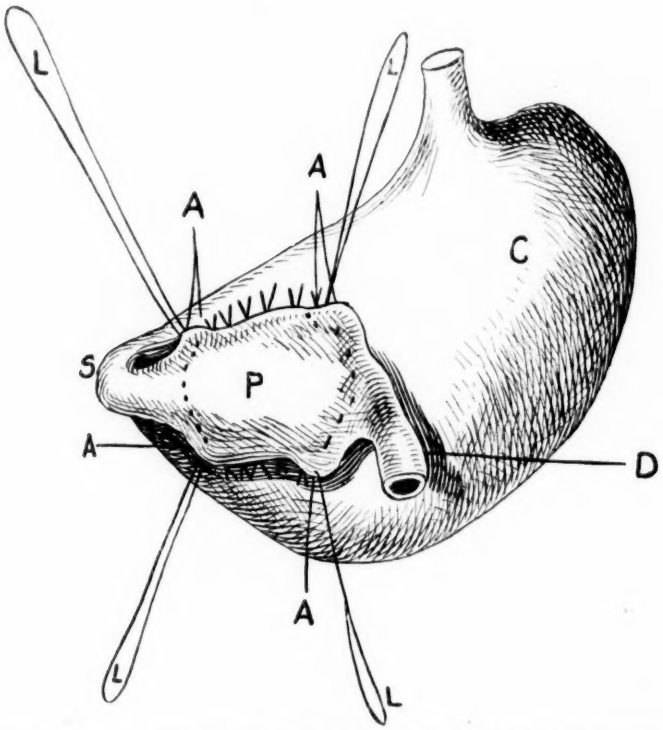


FIG. 22.—L, L, L, L, long sutures at each side of ends of elliptical sutured surfaces; C, cardiac chamber upon which P has been turned over and sutured; P, pyloric chamber; A, A, A, A, line of sutures (shown as a dotted line where they pass *under* the pyloric chamber); D, duodenum.

ligament by dense adhesions. The anastomosis was accomplished by making oval incisions seven centimetres long,

through corresponding points of the dependent portions of the two divisions of the stomach. The posterior halves of the incisions were first brought together and united, two rows of sutures being used,—one for the mucus and one for the serous and muscular layers; the remainder of the incisions was then closed in the same manner; these steps are shown in Figs.

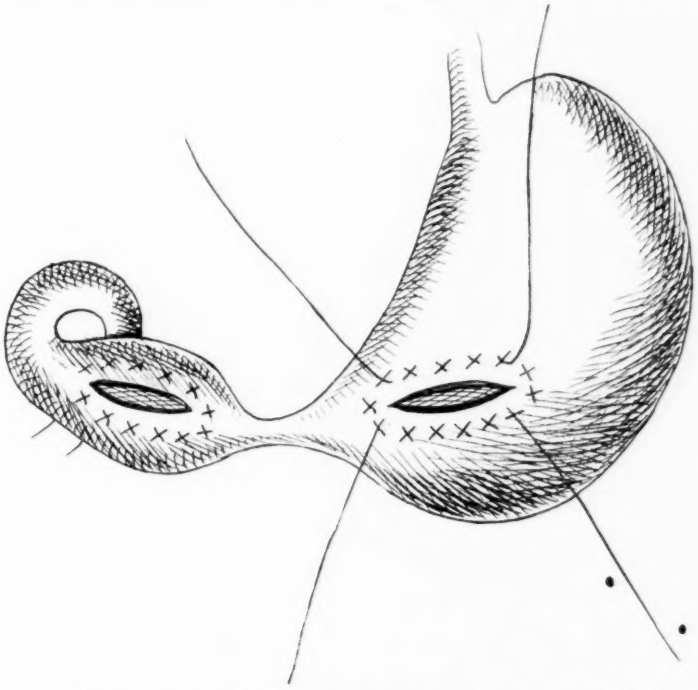


FIG. 23.—The two halves of the stomach are here shown as they would be if turned back to their original positions, in order to demonstrate the shape and positions of the sutured surfaces through which the communications were made, and also the points at which the long sutures were placed. This was not, of course, actually done at the operation; the figure is inserted to make the demonstration of the operation clearer.

17, 18, and 19. The patient made a most admirable recovery and was relieved of all symptoms.

In the writer's case the abdomen was opened by an incision from the tip of the xiphoid cartilage to about two-thirds of the way to the umbilicus; from there it was carried at nearly a right angle to the border of the ribs on the left side. (Fig. 20.)

A typical hour-glass stomach was exposed, both divisions of which were dilated, and their walls being thin, could readily be brought into apposition. (Fig. 21.) The steps of the operation were as follows: The pyloric portion was raised and turned over onto the cardiac, the constriction being used as a hinge, thus making it, the hitherto injurious feature, become a useful technical agent. (Fig. 22.) The next step consisted in uniting the two parts of the stomach to each other in the position just described and previous to making the communicating opening, the object being to defer doing the latter until the end of the operation, in order to avoid spilling the stomach contents into the peritoneal cavity. This union was

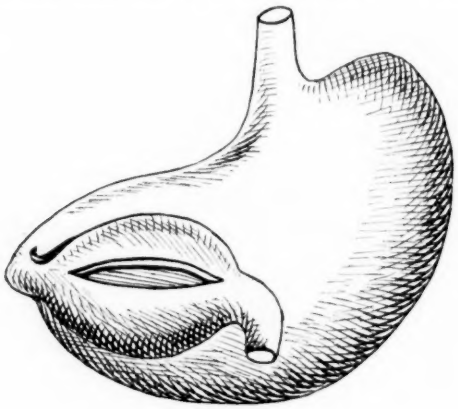


FIG. 24.

accomplished by means of a single line of fine silk sutures passed through the serous and muscular coats of the two halves of the organ and uniting them by a portion of their surfaces having an elliptical form and measuring three and a half inches in length by about one and one-half inches in width. (See Figs. 22 and 23.) One suture was left long at each side of the two ends of the ellipse in order that the limits of the sutured area might be defined by traction upon them at the moment of making the communicating openings, as will be seen later. (Fig. 22, L, L, L, L.) The two compartments of the stomach being thus attached to each other, there remained but one way to gain access to that part of their surfaces which was

held in apposition within the elliptical line of sutures, and through which the communicating openings must be made, and that way was through the presenting surface—the roof, so to speak—of the pyloric compartment; this was accordingly done by a short incision through that part as shown in Fig. 24. The edges of this incision being held up by tenacula and the contents of the pyloric chamber being sponged out, there was no

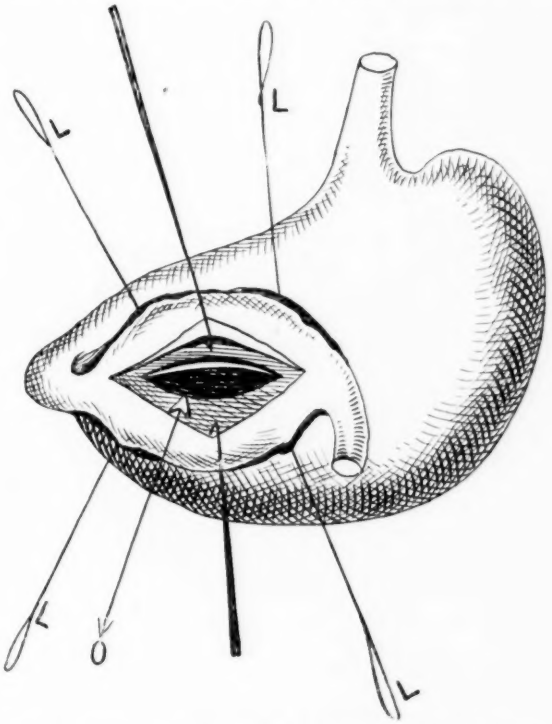


FIG. 25.—Showing wound in roof of pyloric division of stomach held open to give access to elliptical sutured surfaces through which communicating openings, O, are made; L, L, L, L, long sutures.

soiling of the peritoneum by it. Traction was now made on the four long sutures, and the length and breadth of the sutured ellipse was thereby at once defined, and its surface was moreover made tense. A scalpel was passed through the walls of both chambers of the stomach at a point close to one end of the ellipse and carried to its opposite end, thereby establishing

communicating openings between the two halves of the stomach by incisions through the walls of both, which incisions being made by one and the same stroke of the knife necessarily corresponded exactly in all respects. The cuts lay in the direction of the long axis of the stomach midway between its greater and lesser curvatures, and were about three inches long. (Fig. 25.) A widely spaced button-hole suture was applied over the edges of the incisions to avoid their opposite sides uniting. Closure of the wound in the roof of the pyloric half of the stomach completed the operation. (Fig. 26.) The abdominal wound was closed tight. The patient was fed with nutrient enemata for five days, with liquids by mouth until the tenth,

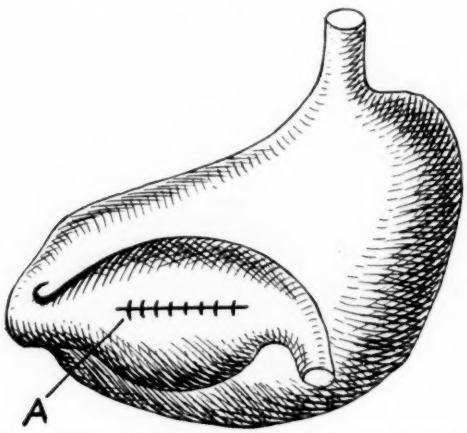


FIG. 26.—The operation completed; A, wound in roof of pyloric portion closed.

thereafter by solids. Patient discharged well twenty-first day. The convalescence was uneventful; there was entire relief of all symptoms from the first. There was a gain in weight of forty-two pounds within the first year. This patient reported to me personally at intervals since the operation up to six months ago, that is to say, for four and a half years. She has been in excellent health during this time; worked hard, been free from symptoms; the only change she has noticed has been a loss of twelve of the forty-two pounds she gained at first.

In February, 1900, the writer had a second case, which presented some interesting features.

The history was clearly that of gastric ulcer of long duration, with acute symptoms, beginning about nine hours previous to her entrance to the hospital, indicating perforation. On opening the abdomen the stomach was found to be attached to the anterior abdominal wall by a dense mass of adhesions, which extended in various directions binding the stomach to the pancreas, the gastrohepatic ligament, and the left lobe of the liver, and covering as well the whole of its anterior surface over a space three inches in width between the two curvatures about the middle of the organ. There was also an offshoot from the middle of the lesser curvature extending onto the duodenum and the pylorus, which had drawn them upward and over onto the lesser curvature at a point about three inches above the pylorus and bound

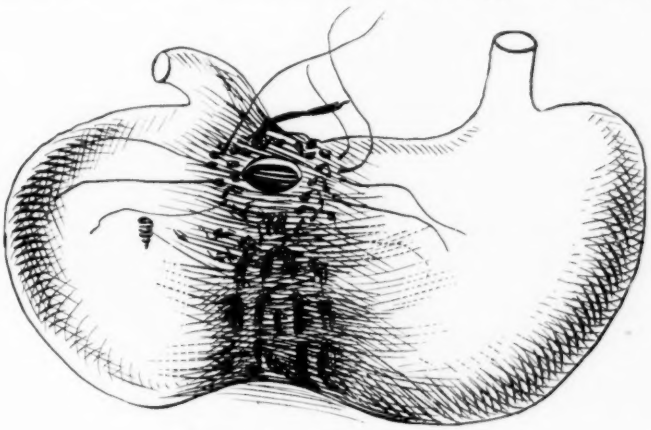


FIG. 27.—Second case (Watson).

them there firmly. On separating the adhesions a perforating ulcer admitting the tip of the little finger was found situated close to the middle of the lesser curvature. Stomach contents had forced a passage through the adhesions at one point and had flowed downward through the peritoneal cavity along the flanks as far as the pelvis, setting up a more or less diffuse peritonitis. The adhesions, except those which involved the pancreas, were separated between the stomach and the adjoining structures, and the ulcer was inverted and sutured. The abdominal wound was closed partially and the peritoneal cavity was drained through it and by counter-openings in its lower part after thorough irrigation. The patient, after apparently doing well for three days,

died on the fourth of septic peritonitis. The autopsy disclosed an hour-glass stomach having a constriction admitting one finger, situated near the middle of the organ and covered with a large mass of cicatrices—resulting from former gastric ulcers healed—and adhesions as already described. So dense was this mass that it had entirely concealed the contour of the constriction, and it was not recognized at the operation at all. (Fig. 27.)

Adhesions are likely to play an important part in cases of hour-glass stomach, and the excellent results which have attended operations for freeing the stomach from adhesions—gastrolysis—should not be forgotten in the treatment of the hour-glass constriction, and the operation should not be considered complete until the adhesions as well as the contraction of the organ have been dealt with, whenever the patient's condition will allow of its being done.

Choice of Operation.—This must be determined by the conditions met with in each case. Thus, gastro-anastomosis cannot be done when either half of the stomach is very small, or thick walled and inelastic, or when adhesions which cannot be separated bind the stomach to neighboring structures in such a way that the two portions cannot be readily brought together, or if the pyloric half has to be carried over so far in order to make the union as to threaten occlusion of the pylorus or the upper part of the duodenum by producing a sharp bend at that point.

The objection to gastro-enterostomy is that it is, of course, impossible to apply it to the lower division of the stomach, and inasmuch as the upper or cardiac half is frequently injured, so far as its digestive function is concerned. The benefit, therefore, of the digestive capacity of the pyloric half is lost. It is also open to the usual objection to gastro-enterostomy performed under other conditions, viz., the troubles likely to arise from stasis of ingesta in the bowel above its point of junction with the stomach, or, if steps are taken to prevent this, it necessitates an operation of much greater length than either gastro-anastomosis or gastroplasty.

The gastroplastic operation is inapplicable in the presence

of very extensive cicatrices or adhesions in the constricted area, because of their making the edges of the incision too rigid to allow of good adaptation or preventing their being brought together at all, or not leaving enough sound tissue on either side of the constriction to give good holding ground for the sutures. Finally, there is often difficulty in securing sufficient additional enlargement by the incision, and the tendency to relapse is greater than in either of the other methods mentioned above. Resection of the constriction would scarcely be considered except in the simplest cases,—those which were free from pathological change,—its danger being much greater than in the other methods, under any other conditions than the simplest.

When the circumstances are suitable to its performance, *gastro-anastomosis* seems to the writer to be much the most desirable operation. It has all the advantages without any of the drawbacks of gastro-enterostomy; it allows large communicating openings to be made as compared with the plastic operation. It avoids the area of cicatrices; it has the great additional value of utilizing the digestive and motor functions of the pyloric half, and preserves the natural outlet of the stomach undisturbed.

The advantages of the writer's method of doing the anastomosis are the avoidance of the larger blood-vessels by placing the communicating openings midway between the two curvatures of the stomach; lessening the risk of infecting the peritoneum by the stomach contents, secured by the complete suture of the two halves of the organ previous to making any incisions in it; and, lastly, having an exact correspondence of the two communicating openings in all respects, which is insured by their being made by one and the same stroke of the knife.

BIBLIOGRAPHY.

[Copied from Bettman's article in Philadelphia Monthly Medical Journal, March, 1899, Vol. I, No. 3.]

Chronological List of all Cases of Hour-glass Stomach upon which Operations have been made.

Bauermeister: Ein Fall von "Ulcus ventriculi chronicum" mit Sanduhrmagen, Dissertation Inaugural, Halle, 1890.

Nissen: Zur Frage der Indication der operativen Behandlung des runden Magengeschwürs, St. Petersburg med. Woch., 1890, Nos. 40, 41.

Schmid-Monard: Ueber Sanduhrmagen, Münch. med. Woch., No. 19, 1893.

E. Doyen: Traitement Chirurgical des Affections de l'Estomac. Paris, 1895, pp. 308-311.

Wölfler: Ueber die Gastro-anastomose beim Sanduhrmagen, Beitr. zur klin. Chir., 1895, Vol. xiii, p. 220, *et seq.*

Eiselsberg: Ueber Ausschaltung inoperabler Pylorusstrikturen, nebst Bemerkungen über die Jejunostomie, Arch. f. klin. Chir., 1895, p. 919.

Bouveret in Perret: L'Estomac Biloculaire, Thèse de Lyons, 1896, p. 67.

Schwarz: Ein Fall von Sanduhrmagen; zwei Laparotomien; eine Gastro-anastomose, dann Gastrolyse, Heilung, Wiener klin. Woch., 1896, No. 25, p. 548.

Lauenstein: Ein Fall von Sanduhrmagen, operativ behandelt nach Wölfler, Münch. med. Woch., 1896, No. 21, p. 491.

Langenbuch: Report of a meeting of the "Freie Verein der Chir.," Berlin, held March 9, 1896, Berliner klin. Woch., 1896, September 21, p. 855.

Watson: Hour-glass Stomach due to Cicatrization of Gastric Ulcer, Boston Med. and Surg. Jour., April 2, 1896, pp. 338-340.

Hofmeister: Zur operativen Behandlung des Ulcus Ventriculi, Beitr. zur klin. Chir., Vol. xv, 1896, p. 351.

v. Noorden: Zwei operative Eingriffe wegen Folgezustanden von Magengeschwüren, Münch. med. Woch., 1896, pp. 817-819.

Eiselsberg: Casuistik der Resectionen und Enteroanastomosen am Magen und Darmkanal, Arch. f. klin. Chir., 1897, pp. 602-604.

Hochenegg: Ein Fall von Sanduhrmagen geheilt durch Gastro-anastomose, Wiener klin. Woch., 1898, No. 21, pp. 514-517.

Courmont: Quoted by Hochenegg.

Cheyne: Report of a Case of Hour-glass Stomach; Operation: Recovery, Lancet, 1898, Vol. i, pp. 785, 786.

Cases of Congenital Hour-glass Stomach.

Struthers: Cases of Double Stomachs, with Observations (two cases), Monthly Jour. of Med. Sc., Edinburgh, 1851, Vol. i, p. 121; also in Edinburgh Med. Journ., 1861, Vol. vi, p. 677.

Stocker: Hour-glass contracted Stomach, Medical Press and Circular, 1869, p. 183.

Carrington: Notes on Three Cases of Hour-glass Contraction of the Stomach, Trans. Path. Soc., London, Vol. xxxiii, 1882, pp. 130-138.

Williams: Ten Cases of Congenital Contraction of the Stomach (eleven cases), Jour. of Anat. and Physiol., 1883, Vol. xvii, p. 460 *et seq.*

White: Trans. Path. Soc., London, Vol. xxxv, 1883-4, p. 196.

Maier: Beiträge zur angeborenen Pylorusstenose, Virch. Archiv, 1885, Vol. cii, p. 423.

Kammerer: Malformation of Hour-glass Stomach. Report of New York Surg. Soc., March 25, 1881.

Saake: Ein Fall von Sanduhrmagen, Virch. Arch., 1893, Vol. cxxxiv, p. 181.

Hakanson: Ventriculus Bisaccatus, Nordiskt Med. Arkiv, 1894, No. 23.

Hirsch: Ueber Sanduhrmagen, Virch. Arch., Vol. cxl, 1895, p. 459.

Musser: Hour-glass Stomach, Med. Times, Philadelphia, 1884, January 26, p. 330.

Livezey: Hour-glass Contraction of the Stomach, with Thickening and Constriction of the Pylorus, Proc. Path. Soc., Philadelphia, 1867, Vol. ii, p. 30.

Birmingham: Lancet, London, 1893, Vol. i, p. 418. In the report of a society meeting.

Saundby: Deutsche med. Woch., 1891, No. 42.

Baker: Transactions of the Pathological Society, 1866-7, Vol. xviii, p. 105.

Palmer: Medico-Chirurgical Journal, 1816, January.

Doyen: Traitement Chirurgical des Affections de l'Estomac et du Duodenum, Paris, 1895, pp. 308-11.

CASES OF HOUR-GLASS STOMACH DUE TO THE CICATRIZATION OF ULCERS (Exclusive of those found in Table II.).

Peacock: (1848) Trans. of the Path. Soc., London, Vol. i, p. 253.

Robinson: (1853) Trans. of the Path. Soc., London, Vol. iv, p. 134.

Brinton: (1855) Association Med. Jour., London, 1855, Vol. ii, pp. 989-992.

Potain: (1856) Ulcere simple de l'Estomac, Bullet. de la Soc. Anat., 1856, p. 385; also Derouet; Thèse de Paris, 1879.

Paganucci: Gaz. Med. Ital. feder. tosc., Firenze, 1856, pp. 149-152.

Quain: Trans. of the Path. Soc., London, 1856, Vol. vii, p. 192. For Dr. Black.

Guipon: Gaz. de Paris, 1868, No. 2.

Steven: Glasgow Med Jour., new series, 1868, Vol. ii, p. 472.

Iago: Case of Hour-glass Stomach with Cicatrices, Med. Times and Gaz., London, 1872.

Greenfield: Multiple Ulcers of the Stomach, Trans. Path. Soc., London, 1876, Vol. xxvii, p. 168.

Malescot et Huet: Progrès Médical, 1881, pp. 686-687.

Ciarrecchi: Gazette d. osp. Milano, 1884; also in Bullet. di Soc. Lauciasana d. osp. di Roma, 1884, iv.

Herlich: Société de Med. interne de Berlin, seance de 30 Mars, 1885. Printed in Semaine Med., 1885, p. 115.

Hudson: Trans. Path. Soc., London, 1886, Vol. xxxviii.

Turner: Trans. Path. Soc., London, 1887, Vol. xxxviii.

Birch-Hirschfeld: Lehrbuch de Path. Anat., 1887, p. 526.

Finney: Brit. Med. Jour., 1887, Vol. ii, p. 1157.

Langerhans: Virch. Arch., 1888, p. 387, Vol. cxi.

Kern: Dissertation Inaugural, Berlin, 1889.

Lunnemann: Dissertation Inaugural, Wurzburg, 1891.

Merkel: Sanduhrmagen. See Gaz. Hebd. de Med. et Chir., 5 Mars, 1896.

Chauve: Loire médicale, 15 Fevrier, 1896, No. 2.

Odman: Nord. med. Arch., Bd. ii, No. 20.

Rembold, Teissier: In Perret, *loc. cit.*, p. 17.

Grunfeld: Nogle Bemoerkuunger om Cikatricer efter ulcus ventriculi og ulcus duodeni, Hosp. Tid., Copenhagen, 2 R., ix, 1882, pp. 765-785.

Rabe et Rey: Double ulcere de l'Estomac. Ulceration du foie et du pancreas. Retraction cicatricielle intense, avec biloculation de l'Estomac, etc., etc., Soc. Anatom., Mai-Juin, 1897.

Carrel: L'Estomac biloculaire, Soc. des Sciences Med. de Lyon, Mai, 1896.

Le Waid: Perforating Ulcer of the Stomach with Hour-glass Contraction of the Stomach, Medical Record, December 17, 1898, p. 891.

Cases of Moderate Degree of Hour-glass Contraction of Doubtful Significance.

Chapotot: L'Estomac et le Corset, Paris, 1892, pp. 79, 80.

Labat et Langier: Gazette des Hôpitaux, 1851, p. 255.

Doyen: Traitement Chirurgical des Affections de l'Estomac, Paris, 1895, pp. 60, 61. Text case (see photograph).

Exceptional Cases of Hour-glass Stomach.

Marzotti: Di un vomito infrenabile dipendente da strangolamento rotatorio dello stomaco, Revista Clin. di Bologna, 1874, p. 280.

Dini: Dutopia della milza con strangolamento rotatorio dello stomaco, Imparziale, Firenze, 1879.

v. Hacker: Ueber Magenoperationen bei Carcinom und bei narbigen Stenosen, Wien. klin. Woch., 1895, No. 27.

Gunwald: La Médicine Moderne, 1895, p. 37.

Reiche: Zwei Fälle von tiefer Duodenalstenose, Jahrbücher d. Hamburg, Staatskr., Anst., 1890.

Hour-glass Stomach in a Fœtus.

Sandifort: Observ. Anatom. Path., Vol. iii, p. 11.

HOUR-GLASS STOMACH DUE TO CANCER.

Betz: Memorabilien aus der Praxis, 1856.

Sharkey: A Case of Stricture of the Stomach and Œsophagus, with Extreme Atrophy of the Former, Trans. of Path. Soc., London, 1884, Vol. xxxv, pp. 193-195.

Riegel: Erkrankungen des Magens, Wien, 1897, Vol. ii, pp. 507-509.

[NOTE.—The bibliography of this subject as it is given by Bettman in the March number of the Philadelphia Monthly Journal, Vol I, No. 3, 1899, does not include the following list, some of which have been published since.]

Rasmussen: Centralb. f. d. med. Wissen., 1887.

Virchow: Deutsch. med. Wochen., 1895, No. 6.

Mackenzie: Trans. Path. Soc., London, 1896-97, Vol. xlviii, p. 78.

Weiss: Centralb. f. d. Grenzge. d. Med. u. Chir., Jena, 1897-98, Vol. i, p. 393.

Klemperer: Berl. klin. Woch., 1897, p. 37.

Jaworski: Wien. Med. Presse, 1897, No. 51.

Taylor: Proceedings of the Path. Soc. of Philadelphia, April 15, 1898.

Guillemot: Gaz. hebd. de Med. et Chir., Paris, 1899, Vol. xlvi, p. 75.

Siewers: Berl. klin. Woch., 1899, Vol. xxxvi, p. 325, April 10.

CASES OPERATED.

Bier (Four cases): (Bier's four cases are not included in the operated cases table of Watson's article; the rest below are) Doctors' Dissertation, Kiel, 1898.

Zeller (1893: Centralb. f. Chir., 1894, p. 355.

Von Unge (two cases): Centralb. für d. Grenzge. der Med. u. Chir., May 1, 1898.

Eiselsberg (6 cases): Arch. für klin. Chir., 1899, Band lix, Heft 4.

Mayo Robson (1899): Lancet, March 10, 1900, p. 681.

Cumston (1898): New York Med. Journ., 1899, December 9, p. 237.

Klein: Wiener klin. Rundschau, 1900, February 4.

Bardleben: Klemperer, Berl. klin. Woch., 1889.

Watson, F. S.: Boston City Hosp., February 8, 1900. (See table of operated cases, No. 22, present article.)

THE DIAGNOSIS OF CANCER OF THE STOMACH.[1]

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In all efforts at treatment of cancer of the stomach we are confronted by two relentless facts, which limit our knowledge and ability. One is of a negative and the other is of a positive nature. The first barrier consists in the fact that we do not know what carcinoma is. We do not understand the nature of malignant neoplasms. The second is, that no matter what our methods of treatment, regardless of at how early a date, or with what skill it is executed, the cases treated will eventually and inevitably suffer from a recurrence of the disease. This is an actual fact in 99 per cent. of all gastric cancers that have undergone operation. With such a state of our knowledge, we are condemned to one of three courses. Either we merely go on to do things just as our fathers did, and for no better reasons than because they did them so, or, trusting to some personal authority, we adopt at random the recommendation of some specific in a speculative hope that it may answer; or, lastly,—and this seems the most favorable case,—we ourselves attempt to improve upon certain processes and methods hitherto employed. This improvement may follow as a result of accumulated experience, arranged, corrected, and amplified by master minds; or it may be the result of experimental investigation.

In our present knowledge of malignant neoplasms, the analytical mind remains in the presence of phenomena the

[1] Read before the American Surgical Association (by invitation), Washington, D. C., May 1, 1900.

causes of which are hidden from it. But these causes are capable of being discovered and understood, just as the cause of tuberculosis and of diphtheria was at one time unknown to us, and has been shown to be capable of discovery.

The only diagnosis that can be of interest to a surgeon is an EARLY diagnosis. I have prefaced my remarks in the manner stated in order to emphasize the difficulty of an early diagnosis of any disease the cause of which is unknown, and which does not give prompt and unmistakable clinical manifestations. Many of us can recall the difficulty in the diagnosis of tuberculosis, diphtheria, and malaria prior to the discovery of the specific organisms which were proven to be the causes of these diseases.

Definition of the Term "Early Diagnosis."—The nature and concept of an early diagnosis of carcinoma of the stomach is intimately associated with a knowledge of the *duration* of the disease, which can be approximately, though not definitely, ascertained by three methods: (1) Observing the rate of growth of carcinomas in organs that are open to direct inspection (the uterus, rectum, mammary glands, etc.); (2) by noting the size and rate of growth after the beginning of the subjective and objective complaints in tumors (especially gastric tumors) capable of palpation, and (3) by noting the rate of growth in visible or palpable metastases. Cancer of the stomach may occur and run its entire course in a latent form. Osler and McCrae (*Philadelphia Medical Journal,* February 3, 1900) report seven such cases, in all of which I fail to find any statement referring to chemical and microscopical analysis of the gastric contents. It is true the gastric symptoms were not prominent. These cases show that in cases of obscure or doubtful diagnosis, chemical and microscopical analyses of the gastric contents should be considered as indispensable as the analysis of the urine in similar cases. But latent cancer has been discovered at the autopsy in my own experience, in cases in which frequent chemical analysis of the gastric contents had been made. This occurred in two cases of cancers that arose from gastric ulcers, and in which the secretion of hydrochloric

acid continued to the end of life, and none of the classical signs and symptoms of gastric carcinoma were evident during the clinical history. Such cases, however, are exceedingly rare, and, in my opinion, cases of latent cancer of the stomach will be reported less and less, the more gastric test-meal analysis is undertaken in obscure cases, and the more such analysis is raised to the importance which urinary analysis occupies.

To revert to the duration of the disease, this naturally must vary with the histological nature of the neoplasm. Some neoplasms, such as the scirrhus or the colloid carcinoma, grow rather slowly, and also form metastases slowly. From statistics relating to the results of operation, it is evident that these two neoplasms are also the most favorable to operation (Hemmeter, "Diseases of the Stomach," Section on Surgery, second edition, page 355). On the other hand, the medullary or the adeno or epithelial carcinoma grow more rapidly. In my experience, carcinoma of the stomach has, as a rule, a latent period of three to four months, in which it does not give the classical symptoms of gastric cancer, but clandestinely progresses under the guise of a chronic gastritis or nervous dyspepsia. This is an important period for the clinician. An early diagnosis means the recognition of gastric cancer during these three or four months, when he is confronted with nothing but the symptoms of chronic gastritis or nervous dyspepsia. Such a diagnosis is unfortunately only rarely possible. The first and main obstacle in the way is the indolence and procrastination of the patient, and sometimes, unfortunately, also of the practitioner in charge. The second obstacle is found in the fact that the methods necessary to effect such a diagnosis which are thus far available, are time-robbing, require great patience and persistence, and a knowledge of chemistry and microscopic technique, only exceptionally met with, or capable of application in general practice. Later on I will formulate a number of guiding principles, however,—as much as has so far crystallized out of the study and investigation concerning the clinical history of cancer, which might serve the practitioner as a criterion, at what time such cases of chronic gas-

tritis or nervous dyspepsia should be transferred to the surgeon. But I should like to premise what I shall have to say concerning the chemical and histological technique of the early diagnosis, by stating that the simple continuance of a chronic gastritis or nervous dyspepsia in spite of logical and scientific treatment, accompanied with progressive loss of body weight, during three to four weeks—these two factors alone justify the suspicion of a latent gastric carcinoma.

The ingenuity, immense amount of investigation and indefatigable perseverance which have been bestowed upon the chemical and histological methods of diagnosis of gastric carcinoma cannot but excite universal admiration. But in my experience they are of no greater help to the clinician for the recognition of this disease than the simple continuance or even aggravation of a chronic gastritis and progressive loss of body weight (though every other symptom and sign may be lacking) in spite of proper treatment.

In the following I will consider seriatim the various clinical methods employed for the detection and recognition of carcinoma of the stomach. I will employ the right of the conservative clinician, viz., the critical faculty of determining the actual value of these aids and the deduction of practical conclusions from their association.

Age.—According to the tables of Brinton, 600 cases, Welch, 2075 cases, and Haberlin, 11,424 cases, three-fourths of all cases of gastric cancer occur between the ages of forty and seventy. The factor of age should, however, be only used with the greatest caution. Of sixty-six cases of Lindner and Kuttner, more than one-half of the patients had not reached the fiftieth year. The same can be said of Hammerschlag's cases. I have repeatedly had the experience that general practitioners have failed to recognize cancer of the stomach on account of the youthful age of the patient. Now, Wilkinson has reported a case of congenital gastric cancer, Cullingworth one in a child five weeks old, and Widerhofen a congenital cancer; Kaulich a colloid carcinoma in a boy one and a half years old. According to Schaffer, the percentage of gastric cancers in

the first three decades is two per cent., according to Reichert three per cent., and according to Bräutigam 2.5 per cent. (See Inaugural Dissertation, von Reinhold Schulz, Breslau, 1886.) One fact I should like to emphasize in connection with the question of age, and that is that the limit of age for carcinoma is gradually receding.

Diagnostic Value of the Subjective and Objective Symptoms.—Among all the dyspeptic complaints, the disturbances of the appetite, thirst, the pressure, distention, and fulness, the eructation, nausea and vomiting, and the irregularities of the stool, there is nothing characteristic. Thirst is a particularly prominent and a very annoying symptom in dilatations caused by pyloric carcinoma. There is nothing characteristic about the pasty, insipid taste, nor about the coated tongue. The pains are not characteristic. The vomiting and nausea when very frequent and copious are suggestive of cancer at the pylorus or cardia. When the two openings of the stomach are free, and only the walls of the stomach are affected, there is in my experience no vomiting at all. The amount that is vomited depends on the degree of dilatation. The food is unchanged.

Significance of Blood and Hæmatemesis.—In my experience, blood is contained in the vomit in one-half of all cases of gastric cancer. Large quantities of blood are rarely vomited, but the characteristic coffee-ground vomit, in consequence of stagnation and decomposition of the blood, is diagnostically important. The more copious the effusion of blood is into the stomach, the quicker does it cause vomiting; for that reason the abundant hæmorrhages in ulcer are often vomited uncoagulated and very little altered, whereas the smaller amounts of blood in carcinoma and gastritis remain in the stomach a longer time, and then show the characteristic coffee-ground appearance. But large hæmorrhages may occur in cancer, and small hæmorrhages may occur in ulcer; and I have seen cases of coffee-ground vomiting in ulcer repeatedly.

Constipation or Diarrhœa.—In the literature of this subject, in which any reference to these points was made, I found that in 75 per cent. of cancers of the stomach there is consti-

pation. In about 20 per cent. there is diarrhœa, and in 5 per cent. only does the stool remain regular. These figures agree with those from my clinic sufficiently to make any alteration needless. F. Müller states that diarrhœa occurs in 35·5 per cent. The greater frequency of constipation is due to the mechanical stenosis by the tumor, and motor insufficiency due to carcinomatous invasion of the muscularis.

Emaciation and Cachexia.—That these symptoms are not characteristic is evident, but they are important because the degree of emaciation will greatly influence the decision on an operation. A frequent question will be, Will the strength of this patient suffice to overcome a severe abdominal operation? The general condition gives no clew to the size of the tumor. A very minute cancer, even when it is at a place where it in no way influences the functions of the body, may depress the nutrition of the entire organism, and irresistibly lead to death. On the other hand, very large tumors on the walls of the stomach may run a long course without disturbance of the general strength and nutrition.

So in all dyspeptic symptoms there is nothing pathognostic for gastric cancer. They occur not only in other diseases of the stomach, but to a large extent in diseases of other organs. The *swelling of the cervical lymph-glands* is a very rare sign, and in my experience occurs only towards the end of the disease, by which time the diagnosis is generally clear.

Condition of the Gastric Functions.—Alterations in Secretion, Absorption, and Peristalsis. (1) The Secretion: During the development of cancer, secretion of hydrochloric acid is generally lost, so that free hydrochloric acid can no longer be detected in the test meals. Towards the end stage, both free and combined hydrochloric acid are entirely absent. It is urgently necessary to be very careful in these determinations for hydrochloric acid. A single analysis, showing sub- or an-acidity, proves nothing at all. If a first test fails to detect free hydrochloric acid, it should be repeated after allowing a longer interval to elapse subsequent to the time at which the test meal was taken. It must be borne in mind that

the gastric mucosa does not secrete hydrochloric acid all over, *i.e.*, in all of its parts. Only the middle portion secretes hydrochloric acid; the pyloric region does not secrete it. Although the degree of reduction of hydrochloric acid secretion depends upon the extent and gravity of the gastritis which is caused by the carcinoma, nevertheless this may be limited to the pyloric region, where it will not interfere with the glandular apparatus which forms the hydrochloric acid. F. Mall (*Johns Hopkins Hospital Reports,* Vol. i) concludes with Heidenhain that the oxyntic or border cells in the peptic ducts are concerned in the production of hydrochloric acid, and the central cells in the production of pepsin. Now, as the pyloric region contains no border cells, a carcinoma may reach as far as the antrum pylori, a distance of from three to five inches, before it will invade the region which contains the acid or border cells. I have seen six cases in which the presence of free hydrochloric acid continued to the end of life. In two of these cases the carcinoma was seen during the operation, and in the remaining four at autopsy. These six cases had not originated on the basis of an old gastric ulcer, but were circumscribed knots of cancer, leaving the mucosa largely intact. In all carcinomas that have arisen from ulcers, free hydrochloric acid in normal or even in increased amounts may continue until death. This is sufficient evidence for the conclusion that the presence of free hydrochloric acid does not argue against cancer of the stomach. On the other hand, absence of free hydrochloric acid is no specific sign of this disease. It occurs in other gastric diseases leading to atrophy; it may occur in diseases of other organs, for instance, diseases of the kidneys, pulmonary tuberculosis, and valvular cardiac diseases, and, as I have shown (Hemmeter, "Diseases of the Stomach," second edition, page 374), free hydrochloric acid is frequently absent, though not necessarily so, in catarrhal jaundice. When free hydrochloric acid is absent, combined hydrochloric acid may still be present; and Schüle argued that the amount of hydrochloric acid deficit was an important diagnostic sign between cancerous and benign diseases of the stomach.

In determining the amount of hydrochloric acid deficit, decinormal hydrochloric acid solution is added to the filtrate of gastric contents until we get a distinct reaction with the Boas resorcin test or any of the other established tests for free hydrochloric acid. The degree of the deficit is, in my experience, no indication of the extent of the atrophy of the secreting apparatus. Very large hydrochloric acid deficits have been discovered by myself in benign diseases of the stomach. The determinations for hydrochloric acid, however, when taken in conjunction with other symptoms and signs, have a certain limited diagnostic significance.

Secretion of Pepsin and Chymosin or Rennin.—As a rule, the reduction of the secretion of these ferments goes parallel with a reduction of the hydrochloric acid secretion. For clinical purposes, the determination of the presence and strength of the pepsin secretion may be made according to the method of Hammerschlag (*Archiv für Verdauungskrankheiten,* Vol. ii, p. 4), though this method from a chemical stand-point is by no means exact. Hammerschlag used the Esbach albuminometer to determine the amount of albumen which has not been digested by the pepsin of the gastric contents. As this method is not exact when used for urinary analysis, it is less so for this purpose. Still, as a rough clinical test, it generally suffices.

Method.—A 1 per cent. solution of albumen containing free hydrochloric acid to the amount of 4 per 1000 is filled into the Esbach albuminometer to the 10 cubic centimetre mark. To this tube we add 5 cubic centimetres of the gastric filtrate to be tested for pepsin. A second Esbach albuminometer is filled to the 10 cubic centimetre mark with the standard egg albumen and hydrochloric acid solution, and as a control test 5 cubic centimetres of distilled water are added. Both tubes are now put in the incubator at a temperature of 37° F. for one hour. Then the amount of albumen in each is determined by the Esbach reagent. After both tubes have been allowed to stand quietly for twenty-four hours, the amount of digested albumen can easily be calculated in numbers expressing the percentage. This test is not sufficiently delicate to demonstrate small amounts of pepsinogen.

The reduction of the *chymosin* or *rennin* occurs in all gastric carcinomas except those arising from gastric ulcers, but very marked reduction of the amounts of both ferments is in itself not a characteristic sign for gastric cancer, because it can occur in atrophy of the mucosa from gastritis, and also from long-standing diseases of other organs.

Lactic Acid.—In 112 cases of carcinoma of the stomach, I found only three in which lactic acid was present to any considerable degree before the diagnosis could be made by other symptoms. The frequent occurrence of lactic acid in gastric cancer has been asserted by Boas to be an important diagnostic sign. The question is, Does it occur at a time to enable us to make an early diagnosis? This I must deny on the basis of a large experience with this test. Boas has admitted that excessive lactic acid in the stomach contents is not a pathognostic sign of cancer of the stomach, because it is absent in a number of cases of that disease, and may be present in gastric diseases of a benign type, and even during diseases of other organs.

Three conditions are necessary, possibly four, to bring about excessive formation of lactic acid in the stomach. These are: (1) impaired gastric motility; (2) absence of hydrochloric acid secretion; (3) reduction of albumen digestion; and, I should add (4), an impaired absorption. Lactic acid is formed in the stomach by the action of lactic-acid bacilli on the carbohydrates. Sticker has shown that the simple passage of carbohydrates through the mouth causes the formation of more or less lactic acid without exception. It is therefore necessary to give a test meal, which shall be, as far as practicable, free from lactic acid, and which shall form little of this substance during the passage through the mouth. Such a test meal has been introduced by Boas in the form of his oat-flour soup (one ounce of Knorr's oat flour boiled in a quart of water, evaporated down to one pint, and seasoned with salt only).

Lactic acid will not form in the stomach in amounts demonstrable by Uffelmann's test, even though the contents stagnate due to arrest of the peristalsis; provided the proteid digestion is still fairly good, and does not fall below 75 per cent.

Whenever there is much lactic acid in the stomach, the proteid digestion will be found to be below 75 per cent. I have made a number of chemical tests, relative to the relation of lactic acid to proteolysis, and confirmed the view that lactic acid may replace the normal hydrochloric acid in this transformation. In the contents of some carcinomatous stomachs the lactic acid was found to be in combination with the proteid of the food. When the mucosa is still capable of secreting hydrochloric acid, this will combine with the albumen sooner than the weaker acid, hence a fairly good albumen digestion signifies still a trace of hydrochloric acid and ferments. But a fairly good albumen digestion can be effected by lactic acid and pepsin in the absence of hydrochloric acid. This chemical factor merits closer investigation. Normally lactic acid, like all other soluble products of digestion, is absorbable. If, therefore, the absorption is made difficult,—which occurs especially when the contents stagnate and the hydrochloric acid secretion is depressed,—the conditions favorable to lactic-acid accumulation will be present. Whenever the movements of the stomach are normal, so that the contents can be expressed into the duodenum within six or seven hours, lactic acid will not develop to a degree that can be recognized by the ordinary tests, although the hydrochloric acid secretion has been lost entirely. Hammerschlag took such a gastric chyme containing no hydrochloric acid, but from stomachs with normal motility, and added the third necessary factor, viz., stagnation, by letting it stand at room temperature. Under such stagnation lactic acid rapidly developed in the chyme. In gastric carcinoma we have the conditions favorable to lactic-acid formation in the majority of cases; *vide* suppression of hydrochloric acid, stagnation of contents, impaired proteid digestion, and impaired absorption, so that lactic acid is found most frequently in cancer of the stomach. Rosenheim found it in 78 per cent., Lindner and Kuttner found it in 60 per cent., Strauss found it in 91 per cent., and I have found it in 82 per cent. of all my cases of gastric cancer. But the conditions necessary to its formation in the stomach can be brought about by diseases

other than cancer; for instance, in benign pyloric stenosis, in atrophic gastritis with motor insufficiency; and even in diseases of other organs. I have discovered lactic acid in the stomach in marked excess when the stomach itself was not affected; but the impaired peristalsis was caused in one case by a pancreatic cyst, in another by a carcinoma of the gall-bladder, and in a third case by a large gall-stone. These conditions had caused compression of the duodenum effecting obstruction to the outlet of gastric chyme with a subsequent gastritis, the latter most probably causing the loss of hydrochloric acid secretions. In still another case in which there was a compression of the duodenum by floating kidney, the presence of lactic acid was only transient. Whenever the kidney could be retained in place by a proper bandage, the stomach resumed its secretions partially, and the peristalsis was to a degree resumed, and the lactic acid, except in minute traces, disappeared from the contents. Lactic acid, then, although it is not an early sign, is a clinically important sign. It means absence of hydrochloric acid, stagnation, and reduction of the digestive ferments and loss of absorption; conditions which are most frequently found in cancer, and therefore the presence of lactic acid, although not a pathognomonic sign, nevertheless, when it occurs in conjunction with other symptoms, should suggest the probability of cancer. The test necessary for this which is most practical is the one originally suggested by Uffelmann. The reagent consists of 10 cubic centimetres of a 4 per cent. solution of carbolic acid, 20 cubic centimetres of distilled water, and one drop of the liquor of the sesquichloride of iron. This gives an amethyst-blue solution. The presence of lactic acid changes this to a yellowish green. The reagent is sensitive to 0.5 per 1000 of lactic acid, which amount is always pathological and of diagnostic significance. Tests more sensitive than this would not be useful clinically. Boas (*Deutsche medicinische Wochenschrift,* 1893, No. 39) has given an exact method for quantitative determination. Strauss (*Berliner klinische Wochenschrift,* 1895, No. 37) has devised a practical little funnel for separating the lactic acid by agitation with ether (for illus-

tration, see Hemmeter's "Diseases of the Stomach," second edition, page 168).

Microscopical Examination of the Stomach Contents.—There are only two structural elements in the stomach contents that have a possible diagnostic significance. These are: (1) tissue fragments, minute portions of the neoplasm; (2) the so-called Oppler-Boas bacilli. The tissue fragments are of undoubted diagnostic value if they contain structure of the neoplasm. The question is, Do they occur early enough in the disease to make a timely diagnosis possible? It is probable that the fragments are only detached from ulcerating tumor masses in the stomach, such as have already developed metastases; but I shall describe a method, that of curetting the walls of the stomach with a soft tube, and thereby loosening the superficial epithelium at a time when the neoplasm is not yet ulcerating. These fragments can be washed out of the stomach by lavage and sedimented in the electric centrifuge. I have used this method in forty-eight cases of gastric carcinoma, and I regard it as eminently important and adapted to early clinical diagnosis. I wish to emphasize that not only fragments of the neoplasm itself are to be sought after, but any cellular tissue that is found should be carefully stained and studied. The most remarkable feature of the sediment from such a stomach, after this so-called curetting, is a large number of cells presenting karyokinetic figures. Rieder (*Deutsche Archiv für klinische Medicin*, Band liv, Heft 6, p. 544) reported a case in which he made a diagnosis of malignant disease of the peritoneum and pleura from finding numerous cells in the exudates, showing indirect and atypic nuclear division. Mitoses occur very frequently. The forms of cell and nuclear division known as the equatorial plate and the monaster are frequent. Another form known as the anaphase, which in normal karyokinesis precedes the formation of the daughter stars, and leads up to the formation of resting daughter nuclei, I have observed three times in the curettage from stomachs at a stage when there was no tumor palpable, and in which the diagnosis was confirmed by operation, au-

topsy, or by the later development of a tumor. The presence of a large number of cells in the stomach after curetting with the stomach-tube, which cells show mitosis, and some of them pathologic or asymmetric mitosis, is very significant, and should stimulate further and very careful examination. Sooner or later a fragment will be obtained which will give the typical structure of carcinoma. For this kind of curetting a soft stomach-tube suffices, provided it has a lower and a lateral aperture, the edges of which scrape away the tiny elevations of gastric mucosa when the tube is moved in and out of the mouth. The procedure should be carried out in the morning before breakfast, when the stomach is empty. This method of obtaining specimens from the gastric mucosa during life is free from danger, and not once in my experience has any pain, distress, or hæmorrhage been produced thereby. In many cases of chronic gastritis, achylia gastrica, and carcinoma, tissue fragments are found in the lavage water without especially making an effort to loosen them, by moving the tube along the gastric walls.

The forcible detachment of larger pieces of gastric mucosa is an accident occurring during lavage by suction or aspiration of the tube, particularly when the instrument is in inexperienced hands. It is followed by copious hæmorrhage, yet pain is rarely complained of. I reported a case of one of my students (Hemmeter, "Diseases of the Stomach," second edition, p. 146), who aspirated a piece of his own gastric mucosa 10 by 4 millimetres; it was followed by a profuse hæmorrhage but no other serious consequences, as uninterrupted recovery occurred under rest and liquid diet.

The Oppler-Boas bacilli are very long, rod-shaped organisms, non-motile, and usually thicker at one end than at the other, presenting the shape of a base-ball bat. Kaufmann and Schlesinger (*Wiener klinische Rundschau,* 1895, No. 15) have isolated these organisms, and asserted them to be of great significance in cancer of the stomach. Riegel ("Erkrankungen des Magens") confirms the occurrence of these bacilli in enormous numbers in carcinoma, and adds that, although there

are numerous fungi that have the property of forming lactic acid in stomach contents, this cannot alter the significance of the Kaufmann and Schlesinger observation. He does not consider these organisms as pathognomonic of gastric cancer, but as very important for the diagnosis. Dr. Harry Adler and myself have examined fifty-six cases for the Oppler-Boas bacilli, and failed to observe them in only three cases. The presence of this organism is therefore an important factor, aiding in the diagnosis; and whilst not pathognomonic, they are of the same diagnostic value as the presence of lactic acid, and therefore do not constitute an early sign of cancer.

Microscopical Evidences gained from the Contents or the Walls of the Stomach.—In the preceding I have briefly outlined my opinion concerning the diagnostic value of subjective and objective signs and symptoms; of the various ways and degrees in which the three functions of the stomach, peristalsis, secretion, and absorption, can be altered; the value of the chemical and microscopical examinations of the urine, blood, and gastric contents. There is therefore not one clinical sign or symptom, chemical or microscopical evidence, which is characteristic or pathognomonic for the fully developed gastric carcinoma, not to speak of the value of these conditions and symptoms for the *early* diagnosis. We are therefore compelled to seek further evidences from which we may hope to obtain information. One of the first and indispensable steps towards the attainment of new truth is to admit the helplessness of our present knowledge, and the inadequacy of our present means of diagnosis. I have attempted to enlarge the diagnostic technique in this respect by efforts at obtaining histological fragments of gastric mucosa by curetting the walls of the stomach with a stomach-tube ("Histological Studies relating to the Early Diagnosis of Carcinoma of the Stomach," *Philadelphia Medical Journal*, February 3, 1900, p. 279). After this curetting the stomach is washed out with a measured quantity of water. If the particles detached from the gastric mucosa are not visible to the naked eye, this lavage water is sedimented in the centrifuge and the sediment examined microscopically. It is not sufficient to simply look for particles of the actual

structure of the malignant tumor in the wash-water. One may occasionally have the good fortune to arrive at a positive diagnosis by finding actual structural fragments of an existing carcinoma, but in my experience such an occurrence always speaks for a neoplasm that has already progressed very far, and which can be diagnosed by other methods, without gastric curage. Structural fragments are only detached from ulcerating tumor masses in the stomach, and in all the cases in which I succeeded in getting such fragments, metastases had already formed, and the diagnosis could not be called an early one. The finding of actual tumor masses, then, is comparatively rare, and while it firmly establishes the diagnosis of carcinoma of the stomach, is of no value to the surgeon in his efforts to secure an early operation. In curetting a very large number of stomachs, for the purpose of studying the histological condition of the mucous membrane, I have been led to hope for some aid to an early diagnosis by a study of the pathologic and atypic mitoses that occur in the gastric structure. The finding of pathological mitoses, and even of carcinomatous particles, is considered an accident by a number of competent observers; but it is probable that this occurrence is said to be so rare, not because these fragments do not occur in the vomit or wash-water, but because they are not methodically and systematically looked for, and especially because few well-directed efforts have been made by competent men to detach such fragments intentionally from the gastric mucosa. There is every reason why we should intentionally attempt to secure such particles from the stomach, just as they are secured by curetting the uterus. Hitherto, in such examinations, the histologist reserved his opinions, as a rule, until he found the typical structure of a carcinoma in the tissue fragments gained. But it is possible to go a step farther, and to diagnose this disease from fragments showing the following conditions. (*a*) The ducts of the peptic glands are elongated and dilated, the cells frequently detached from the periphery of the gland, and lying loose in the gland lumen and presenting numerous karyokinetic figures. (*b*) When these nuclear

figures, or mitoses, present asymmetric or hypochromatic and hyperchromatic forms, they are especially suggestive of a malignant process. These mitoses must be examined in tissue that is as fresh as can be obtained; where the least decomposition had taken place, they are no longer demonstrable by tinctorial methods. For this purpose curage of the stomach is indispensable, as the tissue fragments gained by other methods, vomiting or simple lavage, are, as a rule, in a state of necrobiosis.

The result of the procedure of curage is made more reliable if the patient is fed by the rectum for a time, and all food excluded from the stomach. Wherever possible, the stomach should be thoroughly washed out for several days in succession, in order to avoid confounding particles of meat, etc., retained in the ingesta, with particles of neoplasm. The diagnosis of malignant disease of the peritoneum and pleura from numerous cells found in the aspirated exudate, which cells were in the state of indirect nuclear division, was probably first definitely made by Rieder (*Deutsche Arch. f. klin. Med.,* Band liv, S. 544). The autopsy in Rieder's case proved the existence of a sarcoma of the peritoneum secondary to malignant disease of the ovaries. In the fluids obtained during life cells were found which were remarkable, in the first place, on account of the differences in size and shape of the individual cells. Often there were indentations and constrictions, sometimes buddings. In many cells there were one or many vacuoles, often so large that the nucleus was pushed to one side, and sometimes almost completely submerged beneath the enormous vacuole. Examination of the stained cells showed a large number of cells in a state of indirect division, and especially cells with atypic mitoses. Geo. Dock ("Cancer of the Stomach in Early Life," *Amer. Journal of Med. Sciences,* 1897, p. 65) made similar studies and established the diagnosis of carcinoma of the pleura and peritoneum from analogous cellular forms found in the aspirated transudate. Asymmetric mitosis is not easy to recognize in fragments gained from the gastric mucosa on account of the frequent imperfect preserva-

tion of the chromosomes in many cases. Many fragments are found which are useless for the purpose of studying pathologic mitoses for this reason. The methods and technique are fully described in my text-book on "Diseases of the Stomach," second edition, pages 561 to 564.

In a number of German publications, I have noticed the definition of EARLY diagnosis, to the effect that the disease is

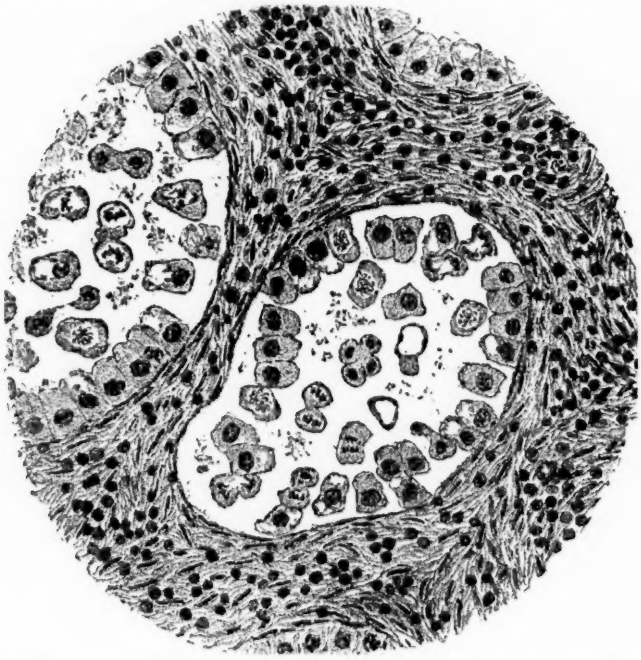


FIG. 1.—Fragment of gastric mucosa obtained by curage from case O. A. B., showing lumen of two gland tubules. The interglandular connective tissue is thickened and permeated with small, round-celled infiltration. The greater portion of the epithelium of the gland is detached; many cells show vacuoles, some of them so large as to submerge the identity of the original cell, which appears either as a small rim of protoplasm around a vacuole, or as a smaller mass at the side of a huge vacuole. Numerous gland cells in the state of atypical mitosis, there are in both glands lumens, asymmetrical mitoses, some with disrupted chromosomes. In the centre of one lumen is a four-lobed cell presenting four nuclei. Asymmetrical mitoses do not derive their name from asymmetry in shape or configuration; an asymmetrical mitosis is one whose daughter stars do not contain a like or even number of chromosomes.

recognized before a tumor can be felt. As fully two-fifths, according to some authors, one-half, of the tumors of the stomach are not palpable, it is evident that this is not a reliable sign to go by. Tumors may be very large, and not at all be palpable. The palpability of gastric tumors depends too much upon the situation of these neoplasms in the stomach; although 60.8 per cent. of the tumors observed at autopsies by Wm. H. Welch (Pepper's "System of Medicine," Vol. ii) were situated in the pyloric region, all of these tumors are not palpable. It is only when the normal pylorus is displaced downward by the weight of the tumor that it becomes palpable. I have observed quite a number of tumors of the pylorus at autopsy which were by no means palpable during life, owing to the fact that the tumor was adherent to the under surface of the liver.

In an investigation on the pathologic anatomy of the human stomach with a special reference to the practical value of diagnosis by means of fragments of the mucous membrane, Leuk (*Zeitsch. f. klin. Med.*, Band xxxvii, Heft 4) holds that it is not possible to distinguish between carcinoma and atrophic gastritis by examining such fragments unless portions of actual carcinomatous growth are found. He does not go into the consideration of the relative frequency of the findings of cells showing atypic and asymmetric mitoses in the contents of the stomach or gained after gastric curage. But few investigators have as yet worked over this subject, as may be seen from the literature in my articles (*Phila. Med. Journ.*, Feb. 3, 1900, and *N. Y. Med. Record*, Oct. 21, 1899, and in the second edition of my text-book on "Diseases of the Stomach"). The whole subject is not sufficiently mature to permit of the annunciation of dogmatic conclusion either way. I wish simply to emphasize that the diagnosis of carcinoma of the stomach *has* been made in this way, at a time when we had every good reason to believe that it was an early diagnosis, and that this opinion was confirmed either at operation or at the eventual autopsy. Leuk's work, in my opinion, is not based upon a sufficiently large number of clinical observations, as might be desirable for the importance of this question. It is confessedly

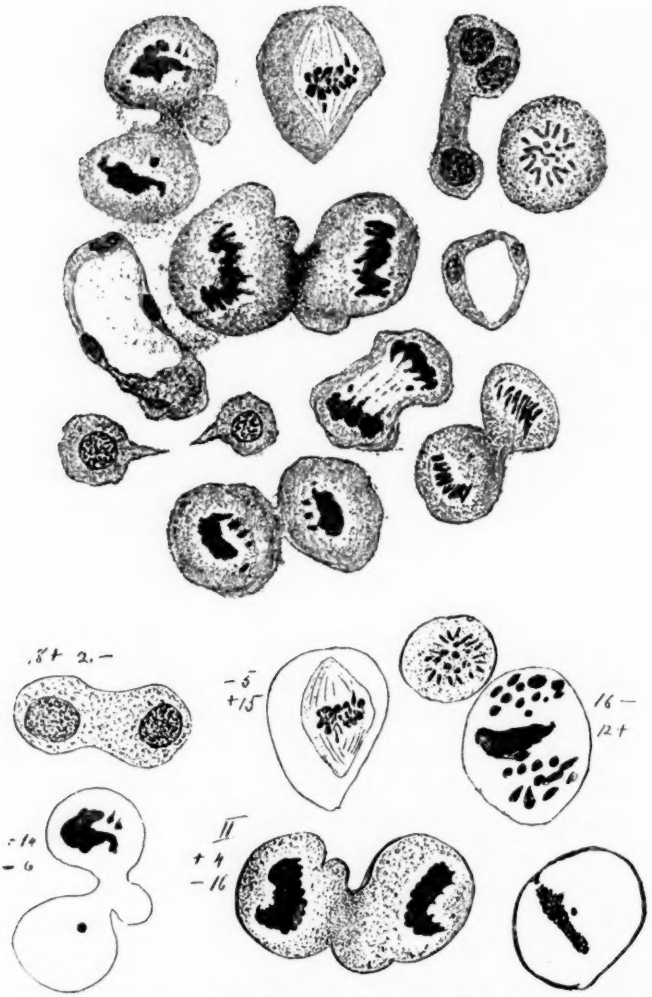


FIG. 2.—This gives a number of cells in the state of atypical mitoses, taken from parts of the specimen illustrated in a lower power on Fig. 1. To the left side, above the centre, is a mitotic form showing a cell with a huge vacuole and three nuclei; directly opposite on the right side of the drawing is a similar smaller cell in which the protoplasm has surrounded a vacuole like a narrow ring. The lowest cell in the figure is an asymmetric mitosis, showing an uneven number of chromosomes and disrupted chromosomes. This is also shown in other cells of the illustration, particularly in the cells showing a crippled pithode stage. The cells thus pictured were discovered lying detached in the lumen of the gland-ducts as shown in Fig. 1.

a rare thing that the diagnosis of carcinoma of the stomach at an early stage can be made in this manner; but this I explain on two grounds: (1) It is rare that patients present themselves at an early stage for examination; and (2) the method of gastric curage is rarely practised. I am of the opinion that, as the method comes more and more into usage, we may hear of a larger number of early diagnoses of this disease being made.

Wherever appreciable quantities of lactic acid are regularly found in the stomach, together with the signs stated in the preceding, the matter of an EARLY diagnosis is out of the question. The presence of tumor or metastases, the presence of considerable quantities of lactic acid and Oppler-Boas bacilli, the reduction of the proteid digestion under 30 per cent., with absence of free hydrochloric acid, mean a late diagnosis from the surgical stand-point.

The test of the peristalsis or motility of the stomach should never be omitted from the diagnostic methods. In the majority of cases the peristalsis suffers greatly, but in cancers located at the fundus and at the curvatures the motor power of the stomach may remain normal throughout the course of the disease. There are even rare cases of pyloric cancers in which motor power may remain intact for a long time.

Absorption.—The tests for the absorptive power of the stomach usually give evidence of great reduction in this function. There are, however, many exceptions to this rule, no doubt due to the fact that the gastric mucosa is in a fairly normal condition, notwithstanding the presence of a very circumscribed carcinoma.

Urine.—Investigation made hitherto on metabolism and the constituents of the urine have, in my opinion, not as yet yielded any results of practical value for the diagnosis Albumen is present in from 35 to 50 per cent. of the cases according to F. Müller. Excess of indican is present in from 85 to 90 per cent. of the cases.

Blood Examinations.—These have shown a reduction in the percentage of hæmoglobin and absence of the digestive

leucocytosis. Frederick P. Henry has emphasized the fact that in gastric carcinoma the red corpuscles number 2,000,000 to 3,000,000 per cubic millimetre, whereas in pernicious anæmia, which most resembles cancer of the stomach, the count is much lower, sometimes less than 500,000 (*Archiv für Verdauungskrankheiten*, Band iv, S. 1). This phenomenon will serve to distinguish these two diseases.

The number of erythrocytes is not proportionate to the degree of cachexia. In this opinion Henry has been confirmed by Dr. Anton Krokewicz (*Archiv für Verdauungskrankheiten*, Band vi, p. 25). My personal experience is that the numerical relations of the cellular elements of the blood are too variable to constitute a reliable diagnostic factor in gastric carcinoma.

Tumor.—Demonstration of a tumor in the stomach is the most reliable evidence upon which to base a diagnosis, but it is not an early diagnostic sign. According to various prominent German surgeons, the presence of a tumor is a contraindication to the execution of a radical operation having in view the total extirpation of the neoplasm. Czerny and Rindfleisch (Festschrift gewidmet Theod. Billroth, 1892) and Kraske (*Berliner klinische Wochenschrift*, 1894, Nos. 20 and 21) argue that gastric cancer should not be radically operated upon after it can once be diagnosed in the form of tumor. It will not be necessary for me, in this short article, to consider the methods of palpation and the mobility of gastric tumor, but I should like to recommend urgently the palpation of the patient, either in a warm bath or under anæsthesia, when a tumor cannot be made out by palpation under ordinary conditions.

Hypertrophic Stenosis of the Pylorus—Stenosing Gastritis.—The differential diagnosis between this condition and carcinoma is difficult. W. S. Thayer and Rosenheim have reported cases of benign stenosis that could not be distinguished from carcinoma. A history of very long-standing dyspeptic disease, with alternating improvements and aggravations, speaks for hypertrophic stenosis if the symptoms and anamnesis of chronic gastritis accompanied the development of the

stenosis. The presence or absence of tumor is of no diagnostic value in differentiating these two conditions. A tumor when present may as well be a benign hypertrophy as a cancer. Repeated and consecutive weighing of the patient is urgently indicated in benign hypertrophic stenosis; there will be more frequent and more lasting improvements, extending sometimes through years. Motor function and stagnation grow progressively worse in carcinoma; in benign stenosis they are amenable to treatment by lavage and diet.

In stenosis due to cicatrix from gastric ulcer there will have been a history of blood in the vomit or stool and presence of excess of hydrochloric acid in the gastric chyme; if the stenosis is due to hypertrophic gastritis, these signs will not be observed, though normal amount of hydrochloric acid may exceptionally be met with in the early stages of the latter.

Among all the early signs and symptoms of gastric carcinoma, the dyspeptic symptoms and the evidences of disturbed functions, and the general condition, there is not one fact that is pathognostic for an early diagnosis. I do not assert, however, like Haberkant, Lindner, and Kuttner, that in the present state of our knowledge the early diagnosis of gastric carcinoma is entirely impossible.

Diseases of the Stomach associated with the Absence of Hydrochloric Acid.—A brief consideration of these will be indispensable in our efforts to reduce the possible sources of error in making a diagnosis. The atrophies that may be associated with the absence of hydrochloric acid are the following: 1. Apparently idiopathic (Nothnagel and Fenwick). 2. End stages of long-standing chronic gastritis. 3. Gastric atrophies occurring with mammary, uterine, and intestinal carcinoma. 4. With benign pyloric stenosis. 5. With gastric cancer.

Achylia gastrica, which has been first described by Einhorn in 1888, means the complete absence of the secretion of gastric juice, not simply of the hydrochloric acid only, but also of the ferments. So-called anacidity, or achlorhydria, means the absence or loss of hydrochloric acid, but pepsinogen and rennin zymogen are still secreted. Achylia gastrica may be

congenital. The existence of so many conditions connected with the absence of hydrochloric acid is an evidence of the difficulty of utilizing this sign for diagnosis. In Groups 1 and 2, however, the motility is normal; there is, as a rule, no lactic-acid formation, and the course of the disease is generally a long one. The atrophies described by Fenwick under Group 3 have not been as yet carefully studied with regard to their motility and the presence or absence of lactic acid. Group 4, the benign forms of pyloric stenosis are very rare, but they can be distinguished by their long, slow course. If, therefore, the history extends over several years, no importance can be attached to the presence of lactic acid. Achylia gastrica is also a disease of long duration; the motility is always excellent, the appearance of the patient is good, and the condition of the chemistry of the stomach is always the same, showing no lactic acid, no ferments, and no hydrochloric acid.

Neurosis of the Stomach associated with Permanent or Temporary Loss of Hydrochloric Acid Secretions. These conditions are very often perplexing, and might be confused with the diagnosis of cancer, but the presence of hysteria or neurasthenia and the long duration of the disease, together with the result of curetting of the stomach for fragments of mucosa, should make the differentiation possible. Patient observation will eventually detect a period in the course of neuroses when hydrochloric acid is again secreted normally. A neurosis during the course of which a perfectly normal secretion may alternate with anacidity (even achylia), and on the other hand with hyperacidity or supersecretion, was first thoroughly investigated at my clinic. I have proposed the name Heterochylia for this condition.

Gastroscopic Examination.—Whether the gastroscope will enable us to make an early diagnosis of gastric carcinoma is a very remote problem. Gastroscopy has no doubt made distinct advances during the last ten years, but it is connected with so many difficulties and dangers that the general application of this method cannot be hoped for at present. Mikulicz, Kelling, Rosenheim, Revidzoff, and Kuttner have published their studies

on gastroscopic examination of the stomach. After a critical study of their reports, one cannot fail to be conscious of discouragement at the absence of practical results. There is still very little promise in this method.

Electrodiaphany or *Transillumination* of the stomach, according to the method first suggested by Einhorn, may give a suggestion of the existence of a tumor of the anterior gastric wall. But a chance of such a demonstration will be very small. Out of 1300 cases of cancer of the stomach collected by W. H. Welch (Pepper's "System of Medicine," Vol. ii, p. 561), only thirty occurred on the anterior wall, *i.e.*, 2.3 per cent. In order to cut off the rays of the intragastric lamp, a tumor must have a thickness of 1.5-2 centimetres. (Kuttner and Jacobson, "Experiments on Cadavers," *Berliner klinische Wochenschrift*, 1893, No. 89.) These observations have been confirmed by the writer. With a tumor of such dimensions as a requisite, and the extreme rarity of the location of tumors on the anterior gastric wall, I am disposed to consider this method unavailable for the early diagnosis.

The Use of the X-Ray for Diagnosis.—The author was among the first to publish studies of the position and size of the stomach for diagnostic purposes (see *Boston Medical and Surgical Journal*, April, 1896). Boas and Levy-Dorn (*Deutsche medicinische Wochenschrift*, 1898, No. 2) have proposed a method of recognizing strictures of the gastro-intestinal canal by skiagraphy. Capsules coated with an insoluble material and filled with bismuth subnitrate cut off the X-rays, and their position can be recognized in the intestines; but I doubt very much whether this method will exactly locate a carcinomatous constriction, because the intestine is not a simple tube, but a labyrinth of convolutions, superimposed upon each other, so that, even if the bismuth capsule could be recognized, it is absolutely impossible to state whether it is in the stomach or in the intestines, or in what convolution of the intestine it is located.

Exploratory Laparotomy.—This diagnostic incision I would warmly recommend in all cases of gastric disease asso-

ciated with (1) rapid emaciation; (2) absence of hydrochloric acid; (3) reduction of proteid digestion under 30 per cent.; and (4) presence of lactic acid by Uffelmann's test or (5) of numerous long baseball-bat shaped Oppler-Boas bacilli. If all of the above signs and symptoms are present in any case, even of short standing and recent beginning of the disease, and no improvement follows three weeks of appropriate treatment, I should feel justified in making the diagnosis of carcinoma of the stomach even in the absence of tumor, and urge an exploratory laparotomy.

Albert Albu (*Archiv für Verdauungskrankheiten*, Band iv, p. 466) reports a very interesting case in which the exploratory laparotomy revealed an infiltration of the pylorus, which, in his own words, was no thicker than a small chestnut, and proved, after a resection of the pylorus, to be scirrhus. This case had an acute attack of tetany. Recovery after pylorectomy was satisfactory, and the motor function of the stomach restored. In this case the diagnosis was not certain before exploratory laparotomy had been undertaken. The early diagnosis and early operations are extremely rare in the literature of the subject, due to the reasons which I have already stated, viz., that the patients do not present themselves in time, and that the methods which are most promising for an early diagnosis are either neglected or permission for their execution refused by the patient. The most important information from all the physical signs and symptoms, and from the chemical and microscopical investigations, may be arranged in order of their diagnostic value as follows (but I do not desire to be dogmatic in this statement):

(1) Chronic gastritis or nervous dyspepsia with progressive aggravation in spite of proper treatment.

(2) Progressive weakening of the peristaltic power. This can only be confused with the benign stenosis of the pylorus, but in the latter case (the benign stenosis) there is always a normal or an excessive amount of hydrochloric acid. In malignant stenosis there is absence of hydrochloric acid and formation of lactic acid. The diagnosis between benign and malig-

nant stenosis may be difficult at the beginning of the clinical observation of any case, but after two to four weeks of observation should present no difficulties.

(3) Progressive diminution in the amount of free hydrochloric acid with steady loss of peristaltic power.

(4) Persistent absence of free hydrochloric acid and the presence of abundant atypic and asymmetric mitoses after gastric curage, together with other signs of inflammation. (*Philadelphia Medical Journal*, February 3, 1900.)

With such clinical indications exploratory laparotomy should be undertaken, and where this step proved the diagnosis to be wrong, in my experience, it was discovered that conditions were present which necessitated operative interference anyway, such as, for instance, motor insufficiency from cicatrices, indurated ulcers, or adhesions.

In this schema the diagnostic value of the Oppler-Boas bacilli, tumor, lactic acid, are not referred to, because they are late signs. I do not wish to be understood, however, that a surgical operation should not be undertaken when these late signs are present. Many times even the presence of a tumor is not a contraindication to an operation, because a malignant tumor in the stomach may be present, as I have noted on three occasions, and no signs of metastases or infection of the lymph glands discoverable by a careful search at the autopsy.

The diagnosis of carcinoma of the stomach is still in its elementary rudiments. We do not know what the causes and nature of malignant neoplasms are. The diagnosis of any disease under such conditions must be difficult. We must bear in mind that the diagnosis on neoplasms on the surface of the body in their early stages presents considerable difficulty, and in case of the stomach we are required to diagnose these new growths in an organ entirely hidden from view, and almost entirely from touch. With a knowledge of the nature and cause of the disease will come a knowledge of its early recognition and its successful treatment. Think of the condition of the diagnosis of diphtheria and tuberculosis before the cause of these diseases was understood. But from many sides and in many countries dutiful laborers are working

towards the common goal of the cause of this human scourge. Then will come the time where the malignant neoplasm will melt away under the influence of a new treatment, similarly as the pseudomembrane disappears in diphtheria after the injection of antitoxin. There is some reason to believe that not all malignant neoplasms have the same etiology, and therefore will probably not have the same treatment. Recent personal studies have led me to incline to the view that in some carcinomas, at least, we are dealing with a deep-seated disturbance of the innermost metabolism of the individual cells, and that whatever bacteriologic findings can be made in such growths, are of secondary importance or accidental accompaniments. The further development of the subject depends, in my opinion, not so much on bacteriologic investigation as upon the pathologic and physiologic chemistry of the cell; though the problem as yet presents great difficulties, still, they do not seem unsurmountable, even with the means at present at the disposal of the physiologic chemist.

The inevitable recurrence of carcinoma after operation of gastric malignant neoplasm should impress us with the fact that surgical operation cannot be the treatment of the future for such diseases. The impression is spreading that gastric surgery can, after all, only bring symptomatic relief, and, according to the classical testimony of Mikulicz (Chirurgischer Congress, 1896) gastric surgery, after a career boldly and brilliantly begun, has arrived at the height of its capability for technical development after twenty years, and now stands arrested before the natural boundaries of internal medicine, the fundamental pillars of pathology. It does not appeal to reason to assume that this form of treatment, by operation merely, although it is at present the most satisfactory and promising that we possess, represents the limit of human knowledge and ingenuity. The Löffler, Behring, Pasteur, Koch, and Virchow of the future will solve this riddle for us, and the obscurity about malignant neoplasms must vanish before human intellect, and then will come an effective treatment based upon the etiology of the disease. "Life is short, but Art is long." Hippocrates: *Ὁ μὲν βίος βραχὺς ἡ δὲ τέχνη μακρά.*

ADHESIONS ABOUT THE STOMACH.[1]

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SURGEON TO THE MASSACHUSETTS GENERAL HOSPITAL.

THIS paper is limited to the study of adhesions about the stomach and duodenum not associated with malignant disease or any still active inflammation of that region.

Adhesions in this neighborhood may arise as a result of a variety of inflammatory conditions. Most prominent among these are inflammations of the gall-bladder. Ulcers of the stomach and duodenum and acute inflammations of the transverse colon may extend to the peritoneal coat of the infected viscus and cause it to adhere to surrounding parts. Inflammations in and about the pancreas may also give rise to adhesions in this region, but are usually so severe as to lead to a fatal issue or to much more serious conditions than the simple adhesions with which we are now dealing. The adhesions which form in this region may be very thin and lax or may be tough, firm, and thick. Their effect depends more upon their situation than upon their density.

Dense adhesions may cause no appreciable symptoms if they do not lead to distortion of organs, and so interfere with the functional activities of the parts. On the other hand, light adhesions between the stomach wall and the duodenum may produce a decided kink of the pylorus, and so interfere with the permeability of this orifice.

Furthermore, constricting bands may cause dilatation behind the point of obstruction. Halsted mentions having found a dilatation of the first part of the duodenum caused by con-

[1] Read before the American Surgical Association, May 2, 1900.

stricting adhesions, and, as the result of this dilatation, an ulcer (" distention ulcer," Kocher) on the confines of the pylorus. In none of the cases that I have personally observed has dilatation been a marked feature.

The organs which are usually bound together are the pyloric end of the stomach, the first part of the duodenum, the transverse colon, and the gall-bladder, with adjacent portions of the liver. Sometimes all of these may be tied together, and they are very apt to be so when the condition is dependent upon a severe cholecystitis.

Symptomatology.—An examination of the previous history of the patient will often give us information of some earlier attack or attacks of biliary colic or of gastric or duodenal ulcer which may have occurred many years before and have been followed by a long period of comfort. The symptoms which bring the patient under observation may usually be divided into two classes under the heads of Digestive Disturbances and Pain.

Digestive Disturbances.—In some cases gastric trouble of long standing, dyspeptic in character, may be present and cause continuous or pretty constant discomfort. In other cases the interference with digestion appears only occasionally, as a severe attack, intervals of good health separating these attacks by a greater or less interval of time. During a sharp attack the symptoms referable to the stomach are vomiting and inability to take food.

Pain is usually a marked feature. It may be moderate in degree, of the kind known as dyspeptic, or it may appear in the form of severe attacks, in which case it is spasmodic or lancinating, not unlike that of biliary colic.

When severe pain occurs as a distinct attack it usually lasts but a relatively short time, rarely more than a few days, and usually is of a distinctly intermittent character. The pain is usually referred to the epigastrium and the right hypochondrium.

In one case observed by the writer, the attacks, which occurred about four times in the year, were described as be-

ginning with intense pain in the epigastrium, gradually extending along the costal border on the right side until it encircled the body. On the third day the pain extended up into the back of the neck and to the right side of the head and face. Vomiting and inability to take food were present during this time. Relief usually followed free evacuations of the bowels.

In this case an implication of the transverse colon in the adhesions was found; and this seemed to explain the relief which followed the free action of the bowels as well as the further fact, which the patient had noticed, that an attack was unlikely to occur when the bowels were acting with regularity and freedom.

The *diagnosis* is not easy, but a long enduring liability to attacks of gastralgia, for which a careful study of the gastric functions fails to suggest an adequate explanation, should lead one to suspect adhesions; also attacks simulating biliary colic without jaundice justify a like suspicion. In either case an exploratory operation is not only justifiable but is called for.

The operation itself is so simple as to demand little or no comment. The writer would, however, urge that, in all operations where adhesions are found to be the only explanation of the symptoms, an exact observation be made and recorded of the anatomical relations of these adhesions and of the organs to each other; for, in looking up the cases upon which these remarks are based, he has felt very greatly hampered by the lack of information on just these points which are most interesting in connection with this subject. He feels that a collection of cases in which careful notes have been taken might decidedly modify and make more exact the impressions which he has been able to obtain from his study of the subject.

NOTE ON A CASE OF SYPHILIS TERMINATING IN DEATH.

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In view of the rarity with which an attack of syphilis proceeds to a fatal termination, an account of the following case may be of sufficient general interest to warrant its publication.

T. S., aged nineteen, on April 23, 1898, was carried in among the out-patients at the Lock Hospital obviously suffering from a very crippling and cachectic form of syphilis. He had been bedridden for some months, and was forthwith admitted as an in-patient, and the following facts elicited.

His friends stated that he had had three attacks of diphtheria, otherwise, previous to acquiring syphilis, he had always been a remarkably strong, healthy young man.

In October, 1894, he enlisted, serving the first two and a half years in England and Ireland. In February, 1897, he proceeded with the regiment to India, and about the end of the first six months there acquired syphilis, having, in the interval, had two or three slight attacks of malarial fever. He was treated from the first with mercurial pills and Lotio nigra. December, 1897, he was invalided to Netley. During the voyage he began to lose the use of his legs, and on arrival at home was quite powerless. Has always had complete control of the bladder and rectum. On admission into Netley, patient was in a very advanced state of cachexia, the face drawn and an anxious expression. He was absolutely confined to bed, where he lay with the legs rigidly flexed on the thighs. This condition he was unable to alter himself, nor could the limbs be straightened by any manipulation. There was swelling of both knee- and ankle-joints, with marked

tenderness and effusion of fluid, general hyperæsthesia of the surface all over the body; patient shrinking when touched anywhere. There were large serpiginous, punched-out ulcers on both knees, the external aspects of both legs, the right thigh, and behind the right ear. These ulcers were all in a very septic condition, discharging pus and unhealthy in appearance. He was suffering from syphilitic paraplegia and debility. March 11 he was brought before the invaliding board and discharged from the service, March 21. April 23 he was admitted into the London Lock Hospital in an extremely emaciated condition, the thighs measuring nine inches in circumference in the thickest part, and the calves eight inches. The lower extremities were rigidly contracted and fixed; the thighs flexed on the trunk, and the legs on the thighs. He can move his toes and feet at the ankle-joints. Several partially healed punched-out ulcers on various parts of the body. The skin over the knee-joints is red and tender; there is considerable swelling about the right ankle. The reflexes, where they can be obtained, are increased. Ordinary sensation, with the exception of the knee-joints, is neither impaired nor exaggerated.

He remained in the Lock Hospital till June 7, during which time his weight increased from five stone two pounds to seven stone six pounds. For the first part of his stay in hospital he improved considerably. The condition of the limbs was better. Movement being more free and flexion less. There were now no symptoms of paraplegia. He then seemed to pass into a stationary condition, so was advised to go out for one month, taking medicine with him. We next hear of him as having been admitted into the Wandsworth and Clapham Infirmary, July 18. In the interval between leaving the Lock Hospital and being admitted into the Infirmary he seems to have rapidly gone down hill. For the three weeks previous to entering the latter institution he had shown marked signs of mental derangement. He thought the regiment was passing under his back, that the house was on fire, and was at times despondent with religious melancholia. He was restless, sleepless, and noisy on admission. Occasional attacks of dyspnœa and some cough. Appetite capricious. Sordes in mouth. Tongue dry and tremulous. Bowels constipated. Incontinence of urine. Liver enlarged and tender. Bases of both lungs dull. Heart's action racing. Pulse 144.

Inflamed and painful swelling of left knee. Threatening bed-sores over sacrum, great trochanter, and left shoulder. August 7, he had a succession of convulsive fits, and died August 13. Cause of death, cerebral syphilis. There was no autopsy.

In conclusion, I have to thank Lieutenant-Colonel Blennerhassett, R.A.M.C., for kindly allowing me to make use of the notes of the case during patient's stay in the Royal Victoria Hospital at Netley; Mr. J. Ernest Lane, under whose care patient was admitted into the London Lock Hospital; and Dr. J. B. Neal, of the Wandsworth and Clapham Infirmary, for details of the closing scenes in this case.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 14, 1900.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

CAVERNOUS ANGIOMA OF THE TONGUE AND MOUTH.

DR. CHARLES L. GIBSON presented a woman, twenty-eight years old, the mother of four children, who, when about sixteen years old, first noticed a black spot on her tongue. This increased in size very slowly until four years ago, when, after the birth of a child, it began to grow quite rapidly, and extended to the floor of the mouth, one tonsil, and the hard and soft palates.

Dr. Gibson said he was somewhat puzzled as to how to treat the case. Any cutting operation would be very bloody, if not impossible, on account of the extent and character of the lesion.

DR. CHARLES N. DOWD said he had operated upon one case of angioma of the tongue; the growth involved about one-half of the tongue, which was so large that it could scarcely be kept in the mouth. The tumor was cut away without any particular trouble, although the hæmorrhage was rather difficult to deal with. The cut surfaces oozed constantly, as from a sponge. It was finally controlled by the application of silk ligatures. He thought the case shown by Dr. Gibson was amenable to surgical treatment. After thorough stretching, and with the aid of a mouth-gag and retractors, such an exposure is obtained that one can do almost anything in the mouth without the necessity of an external incision. The speaker recalled one case of epithelioma of the tongue and anterior pillar of the pharynx, in which he was able to remove one-half the tongue, the anterior pillar of the pharynx, and a part of the tonsil through the mouth without any particular difficulty after ligation of the external carotid artery, the patient never having a local recurrence.

Dr. George Woolsey said he thought it would prove a very difficult matter to deal satisfactorily with the angioma presented by Dr. Gibson, on account of the extent of the lesion and its uncertain limitations, for it involved not only the tongue but also the floor of the mouth, the soft palate, and the fauces. These growths are progressive and often extend into the surrounding tissues, so that it is difficult to define their limits. The speaker said that on this account a cutting operation would be a serious undertaking and would prove of doubtful efficacy. In a case of angioma of the foot upon which he recently operated the growth extended so deeply into the tissues that it would have been necessary to amputate the foot in order to remove the growth completely.

The President, Dr. Curtis, suggested that electrolysis might be tried.

CHARCOT'S DISEASE OF THE KNEE-JOINT: RESECTION.

Dr. Alexander B. Johnson presented a woman, fifty-eight years of age, who was admitted to the Roosevelt Hospital, November 10, 1899, with the following history:

She is married and the mother of several healthy children. Her husband is also a healthy man. There is no history of syphilis. About eight months ago, while apparently in ordinary health, she received a very slight injury to the right knee-joint, which passed almost unnoticed. In the course of a few weeks thereafter some swelling of the joint appeared, which was not painful. The swelling persisted. She was attended by a surgeon, who considered the trouble a traumatic synovitis of the knee-joint. By him the joint was fixed and kept quiet in plaster of Paris. The swelling failed to subside, and, after rather prolonged fixation, the knee-joint was aspirated and some fluid drawn off. The affection was then regarded as probably tubercular and an injection of iodoform and glycerin was made at this time. The fluid soon reaccumulated in the joint and the knee continued swollen, and a gradually increasing relaxation of the lateral ligaments was noted, accompanied by a good deal of disability. The joint was never painful. Upon admission to the hospital she was well nourished, not notably anæmic. There was loss of knee-jerk on the sound side; there was a beginning perforating ulcer underneath the ball of the foot on each side. There were paræs-

thesia in both lower extremities. Formication and slightly diminished sensibility with sensations of heat and cold. Slight ataxia was also noted. The Argyll-Robertson pupil was absent. Dr. Starr states that out of three hundred cases of tabes dorsalis examined, the Argyll-Robertson pupil was present in 276 cases and absent in the rest.

Upon November 18 the joint was excised under ether. The joint lesions noted during the operation were as follows: Upon opening the joint a large quantity of brownish semitransparent fluid resembling an altered synovia escaped. The cartilaginous surface of the patella was in a condition of fibrous degeneration. At the junction of the cartilaginous surface of the patella with the synovial membrane there were developed numerous cartilaginous and bony plates. The pouch underneath the quadriceps extensor muscle was greatly dilated. The synovial membrane of this pouch was studded over its entire surface with small calcareous plates. The membrane was dark reddish brown in color, rough, and in a condition of papillary synovitis. The cartilages covering the condyles of the femur were in a conditon of fibrous degeneration. The external condyle was normal in contour. The internal condyle presented a deep cavity, measuring more than an inch across and an inch in depth upon its lower aspect, which corresponded to a projection of nearly the same size upward of the condyle of the tibia. The cavity in the femur was everywhere lined with a rough foreign fibrous tissue resembling degenerated cartilage. The lateral ligaments of the knee-joint were greatly relaxed, permitting of wide lateral excursions of the tibia. The semilunar cartilage on the outer side was fairly normal; that upon the inner side was represented by an irregular mass of fibrous tissue infiltrated with calcareous salts. The outer condyle of the tibia was covered by rough fibrous cartilage whose contour was normal. Upon the middle of its posterior aspect there projected upward an osteophyte, measuring one inch in length and three-quarters of an inch in diameter at its base. It was cylindrical in shape and covered by cartilage of normal character. The inner condyle of the tibia presented from its superior surface the projection already referred to. This prominence was surrounded by a deep groove, corresponding to the edges of the cavity in the internal condyle of the femur. The posterior ligaments of the joint were greatly thickened and infiltrated with

calcareous material, so that they could be cut only with difficulty with a knife. The pouches of synovial membrane behind the condyles of the femur were in a condition of papillary synovitis. No area of denuded bone was noted upon the ends of either tibia or femur. Upon section the condyles of the femur showed no abnormality of bone structure, but the application of the saw and drill to the tibia showed an abnormal degree of softness in the external condyle of the tibia and an ivory-like density of the internal condyle, which made the process of drilling for the sutures very laborious. After drilling, the bones were united by two sutures of heavy quadrupled catgut. The skin wound was closed with sutures, and rubber tissue strips were inserted in either angle of the wound for drainage, and the limb dressed and encased from the toes to the groin in plaster of Paris. Following the operation a moderate accumulation of blood-clot occurred in the wound, causing a slight rise of temperature for a few days. This, however, did not require an opening of the wound, and the line of incision in the skin healed by primary intention. A notable circumstance in this case was that the patient did not suffer after the operation from any pain. She slept on the night of the operation quietly without morphine, nor has she ever complained of pain at the site of the operation since. The diagnosis of a neuropathic joint was further strengthened during the time she remained in the hospital by the occurrence of two severe stomach crises lasting each for more than twenty-four hours, and apparently having no relation to the character or quantity of food. She also had a tolerably severe bladder crisis. Her general health has in other respects continued good. Inspection of the radiograph, also presented, shows the bones without any tendency to unite, and this after a period of four months. The femur even seems to be undergoing a certain degree of irregular absorption upon its lower surface, due, possibly, to pressure in walking. With a light plaster-of-Paris case she is able to get about without crutches and in tolerable comfort. During her stay in the hospital of twelve weeks absolute fixation of the knee was kept up. She also received tonics, thyroid extracts, and various preparations of phosphorus. The question of what can be done further in this case will depend upon whether she can get about comfortably with a suitable support from the knee, or whether after a time she may not prefer the removal of

the extremity. From the appearance of the limb at present, bony union between the tibia and the femur is not to be expected.

Dr. Royal Whitman asked Dr. Johnson whether union was to be expected after resection of the joint in this class of patients? In one other case which had come under his observation union has not taken place.

Dr. Johnson replied that while he had never personally seen union occur after resection of a Charcot joint, a number of such cases have been reported. Dr. Hotchkiss had informed him that he had seen such an instance, and Dr. Willy Meyer has had one successful case. It is known that ordinary fractures in tabetics heal very well, and ordinary wounds apparently also heal without difficulty.

Dr. Johnson said he was induced to operate in this case on account of the good condition of the patient and the slight inroads which the disease had made in other directions. The patient now is without the slightest pain and walks with tolerable comfort. A metal splint surrounding the joint would probably render locomotion still more comfortable, or, if the patient desired it, it would be perfectly proper to amputate the limb.

Dr. Parker Syms said that some years ago he investigated this subject quite thoroughly, and he found that while fractures in tabetic patients united very readily,—sometimes even more so than in healthy subjects,—joint excisions did not result favorably.

Dr. Otto G. T. Kiliani said that about a year ago he resected the knee of a tabetic patient, and after apparent union had taken place the entire joint broke down. This was due to a fatty degeneration of the bone, and an amputation subsequently became necessary.

Dr. Ellsworth Eliot, Jr., referred to a case of resection of the knee for Charcot's joint in which the result, ten years after operation, was quite unsatisfactory, the function of the joint being more impaired than it was before the operation. It was impossible for the patient to walk without the aid of a crutch. A secondary operation had been refused. The poor result in the case he had in mind was possibly attributable to the patient's weight, which was at least 200 pounds.

Dr. Gibson said that fractures in tabetic patients did not always heal kindly. He recalled one such case, where he was called upon to amputate because of a fracture of the leg, which failed to unite, although it had been properly treated in a hospital.

SARCOMA OF THE SUPERIOR MAXILLA: REMOVAL: NO RECURRENCE AFTER TWO YEARS AND SEVEN MONTHS.

DR. A. B. JOHNSON presented a girl, aged nine years, who was admitted to the Roosevelt Hospital, September 3, 1897, with the following history: For a number of months the mother had noticed a gradually increasing prominence of the left cheek above the incisor and canine teeth of the upper jaw close to the nose. The swelling had not been painful. There was no history of obstruction of the nasal fossæ. Upon examination, the child was found to be rather pale and undersized.

There was a tumor, firm in consistence with a rounded surface, apparently the size of an English walnut, attached to the left superior maxilla, its centre opposite the canine fossa, not tender, and causing by its presence a considerable deformity of the upper lip and cheek on the left side. The surface of the tumor was a dark bluish red in color; there was no ulceration. Nothing abnormal was noticed in the left nasal fossa nor in the roof of the mouth.

Operation September 13, 1897. Incision dividing the upper lip in the median line following the left ala of the nose upward along the left border of the nose, to near the inner canthus of the eye, and then outward along the lower border of the orbit to beneath the outer canthus.

The flap thus formed was turned upward and outward exposing the tumor. The two upper left incisors and the canine tooth were drawn, and the facial surface of the superior maxilla was cut with a chisel in a line surrounding the growth. The mass of bone and the tumor were then removed. It nearly filled the antrum and was beginning to involve the wall of the nasal fossæ. The floor of the orbit and the hard palate appeared to be healthy. The cavity thus created was packed with iodoform gauze and the wound in the skin was closed by sutures.

The superficial wound healed for the most part by primary intention, and the patient left the hospital in a few weeks. At the present time no sign of recurrence is discoverable. The cosmetic result is satisfactory, and the child's health appears to be good.

The report of the pathologists was that the growth appeared to be an osteosarcoma of a mixed type. The cells were partly

spindle formed, partly irregular; there were numerous giant cells.

Dr. Curtis said that several cases had recently been presented in which operations for malignant disease had been followed by long periods of immunity from recurrence, and the speaker suggested that all the members who had such patients under their control should look them up, and thus assist in gathering statistics on this valuable point.

Dr. George E. Brewer said that about eighteen months ago he operated in a case almost identical with the one shown by Dr. Johnson. The patient was a child of eight years, with a mixed-celled sarcoma of the upper jaw which had infiltrated the bone for quite a considerable area. The entire upper jaw was removed, with the exception of the orbital plate and the zygomatic process. The child now wears an artificial jaw, and thus far has been free from all signs of recurrence.

Dr. Johnson said that more than six years ago, he, together with Dr. Hotchkiss, removed a sarcoma of the lower jaw in a child. The growth was a central sarcoma, forming a very large tumor, and necessitating the removal of one-half the jaw. There have been no signs of recurrence up to the present time.

POST-TYPHOID SUPPURATIVE SYNOVITIS OF THE WRIST-JOINT.

Dr. A. B. Johnson presented a woman, aged twenty-five years, who was admitted to the Medical Ward of the Roosevelt Hospital in October, 1899, with typhoid fever.

She passed through a typical and moderately severe attack of this disease. There were no serious complications. During convalescence, however, her right wrist became tender, painful, and swollen. She developed a slight amount of fever and was transferred to the Surgical Ward.

Upon admission, examination showed the right wrist-joint swollen, tender, and painful; the skin was not reddened. There was marked loss of function. Under fixation the joint grew slowly but steadily worse. A hypodermic needle was introduced into the joint and some drops of pus were evacuated. This pus was sent to the Bacteriological Laboratory of the College of Surgeons and Physicians of the Columbia University, where culture experiments were made by Dr. His, who found that the pus con-

tained a pure culture of typhoid bacilli. The wrist-joint was accordingly opened by a dorsal incision and a considerable quantity of purulent fluid was evacuated. In order to provide for more efficient drainage, the first row of carpal bones, with the exception of the pisiform bone, was removed. The joint was thoroughly irrigated, drained by strips of gauze; the greater part of the wound was closed by stitches and the limb was placed upon a palmar splint. The wound healed in the course of three weeks, and the patient left the hospital December 15, 1899.

At the present time, three months later, she has regained almost completely the functions of the joint; the motions of the fingers are perfect, although her grasp is not quite as powerful as it should be. Radiographs show very well the difference between the one which is a normal wrist and the one the case exhibited. One can see that the second row of carpal bones has accommodated itself very well to the lower end of the radius.

STRANGULATED PROPERITONEAL (RICHTER'S) HERNIA: PARTIAL ENTEROCELE.

Dr. William B. Coley presented a lad, aged fifteen years, who was brought to the Hospital for Ruptured and Crippled at 5 P.M., February 27, 1900, with the following history:

He had had a double inguinal hernia from early childhood, the hernia having been first noticed on the left side at the age of one year and on the right at the age of three years. The herniæ were always reducible until the day before admission, when it came down on left side somewhat larger than usual, and could not be put back. Vomiting soon began, and continued at irregular intervals. The boy stated that he had had a slight movement of the bowels during the day. He had considerable pain, and could not keep any food in the stomach.

A physician was called, and after several attempts was unable to reduce the tumor.

Physical examination at the time of admission showed an elliptical tumor somewhat larger than a goose-egg, situated in the left inguinal region and not extending lower than the external ring. It had every appearance of a well developed properitoneal or interstitial hernia.

The contents seemed mostly fluid; a fluctuation was distinct, and the tumor was perfectly dull on percussion. The large

amount of fluid in the sac, the complete dulness on percussion, together with the excellent general condition of the patient (he was able to walk into the hospital, and seemed to be suffering but little from the trouble), suggesting that the case was one simply of strangulated omental hernia with marked effusion in the sac. The possibility of the presence of gut, however, caused him to advise immediate operation, which was performed as soon as preparation could be made. An incision was made three inches long over the centre of the tumor. The sac occupied a position entirely beneath the external oblique aponeurosis, which had been dissected up in various directions. The aponeurosis was slit up three inches, but this had no influence in relieving or lessening the constriction. On opening the sac it was found to contain about three or four ounces of clear serum, and in addition a knuckle of small intestine tightly gripped by the thick fibrous neck of the sac, which was situated near the internal ring.

The knuckle of intestine was found so placed that while the constriction extended as far as the mesenteric line on one side, on the other it did not quite reach the mesenteric border, and thus the lumen of the gut was not entirely shut off. The bowel was greatly congested, but after the constriction had been relieved and a warm towel had been applied, it regained its normal color sufficiently to make it safe to return it to the abdomen. The sac, which was thicker and very œdematous, was removed and the wound was closed by Bassini's method. A slight drain of iodoform gauze was left in for sixty hours. Union without complication.

A very good historical review of this form of hernia was recently made by Dr. Russell S. Fowler (ANNALS OF SURGERY, May, 1899). He states that in 50 per cent. of the cases the trouble was not recognized, and all of the patients died. Of Treves's four cases three died.

The case here presented is unique as far as I have been able to ascertain, in the fact that it is a partial enterocele in a properitoneal sac.

DR. CURTIS referred to a case of strangulated femoral Richter's hernia in which he was able to make the diagnosis before operation. It involved, perhaps, two-thirds the circumference of the intestine. He treated it by excision of the herniated part and suturing.

PROLAPSE OF THE RECTUM.

DR. ELLSWORTH ELIOT, JR., presented a woman, forty years old, who was operated on by Dr. Briddon last January. She had always suffered from constipation, and for the past year she had noticed a descent of the rectum, which at first occurred only with a movement of the bowels, but subsequently whenever she stood up. The difficulty of reducing the prolapsed bowel gradually increased, and the condition caused her considerable annoyance, on account of the inflammation of the prolapsed mucous membrane and the discharge, consisting of mucus and occasionally blood. At the time of operation the prolapse measured three inches in the transverse diameter, between eight and nine inches in its circumference, and three and one-half inches at the margin. The incision was begun at the posterior aspect of the prolapse, a short distance from the junction of the skin and mucous membrane, and carried down into the lumen of the bowel, cutting through both cylinders. When the incision was carried down anteriorly, a peritoneal sac was found which descended for an inch and one-half below the margin of the anus. Posteriorly, there was no peritoneal sac. With the amputation of the anterior part, the entire lower extremity of the rectum fell down towards the table, presenting nothing more than the descent of the external cylinder. The rectum was then amputated six inches above the anus. The hæmorrhage, which was quite considerable, was controlled by ligatures, and the mucous membrane was brought in contact with the skin. The patient made an uneventful recovery. She has regained a fair control of the function of the rectum, although at times, when the bowels are loose, a small amount of fluid material escapes. This same weakness is noticed when hardened fecal material is in the rectum.

A second patient was shown by Dr. Eliot, a man, forty-two years old, who came to the hospital with a history of hæmorrhoids lasting eight years. Five years ago he had first noticed a prolapse of the mucous membrane of the rectum, and this gradually increased up to the time of his admission, February 18, last. Examination showed a prolapse of the rectum which measured three and one-half inches in its vertical diameter, nine inches in its circumference, and three inches in its transverse diameter. It came down at stool, preceding the discharge of fecal matter. It was becoming reducible with constantly increasing difficulty, some-

times taking fifteen minutes to get it back. The mucous membrane of the bowel had become purplish and congested.

This patient was operated on by Dr. Eliot in the same manner as the preceding case, but with the following modification: A piece of wood, smoothly rounded and covered by gauze, into which a groove had been whittled, was introduced into the bowel and held in place. An incision was then made through the prolapsed bowel anteriorly along the line of the groove, without any attempt, by constriction, to prevent hæmorrhage. The blood-vessels were clamped and then divided. The incision was gradually deepened through the rectal wall until the cavity of the rectum was penetrated. There was no peritoneal prolapse. With the opening of the bowel, the mucous membrane was divided in a circumferential way, extending from the lateral ends of the first incision, parallel with the junction of the anus and mucous membrane, and then, with a large needle and heavy catgut, a strong ligature, or series of ligatures were passed through both cylinders. In this way the two cylinders were sutured together and the blood-vessels in both were surrounded by these ligatures. This was continued around the gut, thus not only suturing the cylinders together, but also preventing any escape of blood after the transverse incision. The anal membrane was then joined to the mucous membrane of the rectum. The hæmorrhage was moderate. There was practically no reaction, and the patient made an uneventful recovery. Since the operation he has been able to restrain the movement of the bowels, excepting when he suffers from diarrhœa.

CASES ILLUSTRATING THE ABILITY OF THE PERITONEUM TO OVERCOME SEPSIS.

Dr. Charles N. Dowd presented a boy, thirteen years of age, whose previous health had been good, when on June 12, 1899, he had a severe attack of nausea without localized pain, but with much discomfort through the abdomen. This diminished. On June 14 his temperature suddenly went up to 106.6° F., but quickly subsided. There was no chill. The attending physician kept him under very careful observation from that time on. The temperature remained in the vicinity of 100°, occasionally reaching 101° in the afternoon. There was no tenderness or localized pain. On the afternoon of June 21, nine days after the first

onset of the symptoms, he complained of pain in the right iliac region. This increased, and his pulse and temperature rose.

On the afternoon of June 22, when first seen by Dr. Dowd, the boy had a septic appearance and was profoundly prostrated; his pulse was 130, his temperature 103° F. by the mouth; it had been 104° earlier in the day. There was great rigidity of the abdominal muscles, tenderness on the right side, and slight dulness. There was also tenderness in the left iliac region on deep pressure. He had no marked tympanites. He lay with thighs flexed. He had involuntary movements of the bowels, micturition was delayed and somewhat painful. The abdomen was opened as soon as arrangements could be made.

On opening through the peritoneum at the edge of the right rectus muscle, there was a gush of thin pus. This was white but thin, without disagreeable odor, being such as is ordinarily called sero-pus. There must have been at least a quart of it in the abdominal cavity. It came from above, from the sides, and from below; it seemed to be disseminated throughout the abdominal cavity. The intestines were red and had very slight flakes of fibrin upon them.

After the removal of the sero-pus, a wall of adhesions was found around the appendix These adhesions were not firm, but still shut in a small abscess which contained a drachm or two of pus, with a distinctly fecal odor. The appendix was perforated and contained a concretion the size of a date stone., It was cut off, the stump was cauterized, inverted, and shut in by a purse-string suture. The small abscess cavity about the appendix was cleaned as carefully as could be done by wiping with sterilized pads. Owing to the exigencies of the operation, hot water was used for irrigation instead of saline solution; about four quarts were used. During the first part of the irrigation the patient was turned on his right side so that the region about the appendix should be cleaned first. Much fluid was left in the peritoneal cavity. A piece of gauze packing was left at the site of the appendix and another led to the pelvis, where there was a decided odor to the pus. Another small piece led upward and another towards the median line. The patient was put to bed in bad condition. The foot of the bed was raised about two and one-half feet. Hypodermic stimulation was used.

During the night he improved somewhat. The next fore-

noon calomel was given in three one-grain doses, at intervals of an hour, which he retained. He also took a little water by teaspoonful doses, and in the afternoon a few grains of Rochelle salts in saturated solution. An enema was given and was followed by a free movement.

At the end of twenty-four hours his condition showed decided improvement, the bowels had moved, and the pulse was 110, the temperature 101° F. The abdomen was flat. He improved steadily. The last piece of gauze was removed about ten days after the operation. During the summer he gained his strength satisfactorily.

This patient illustrates the ability of the peritoneum to deal with an extensive amount of inflammation. The conditions which existed were first a rupture of the appendix, which was accompanied by a rise of temperature to 106.6° F. and severe constitutional symptoms. Adhesions were quickly formed about the infective material, and the general peritoneal cavity did not then become infected, but serum was effused in large amount, as usually takes place in these cases. This gradually became filled with leucocytes, and infection had spread at the time of operation, so that the patient's symptoms were of the gravest nature. The prostration was so great that he could not have been expected to survive another twenty-four hours.

On opening the abdomen the evidences of severe infection were most marked about the appendix, where there was pus with a fecal odor and a thick deposit of fibrin. They were next most marked in the pelvis, where the pus also had a foul odor, and where the intestines showed much inflammation. They were least marked in the upper part of the abdominal cavity. When the incision was first made, the pus, which gushed out, came from this region and was without odor. The intestines here were congested, and the deposit of fibrin was very slight indeed. In dealing with the case, the first indication was evidently to clean the area about the appendix itself. The next indication was to treat the pelvis in a similar way. If these two areas were cleaned, it could be fairly expected that the rest of the peritoneum would take care of the inflammation which existed there. In all this procedure the intestines were handled as little as possible. The ultimate result showed that the infection which was left was not more than the patient could deal with perfectly well.

The estimation of the extent to which the peritoneum can overcome infection brings many interesting problems. A few weeks ago, in removing an appendix after the inflammation had subsided, Dr. Dowd found that its tip was included in a mass of adhesions beside the psoas muscle, and found a concretion there which was either liberated from the appendix or from the adhesions by manipulations. Of course this was a septic substance, and the question presented itself as to whether the peritoneum could be trusted to overcome the infection which came from it and from the end of the appendix beside it. Inasmuch as it had already done so once during the acute attack, the reasoning was fair that it could do so again, or, in case it could not do so, that it would at least shut in the infection by adhesions, and that the abdomen could be reopened if necessary. He therefore closed up the abdomen, and there was no evidence of infection afterwards within the abdomen, although there was a small mural abscess which gave the odor of pus which comes about the appendix, and which must have been infected from the appendix or the concretion. In this instance the peritoneum overcame a degree of infection which caused an abscess in the abdominal wall.

A second patient presented was a woman, twenty-five years of age, who had previously been healthy, excepting for an attack of gonorrhœa. In October of last year she had a severe attack of pain in the right iliac region, accompanied with fever and the formation of a mass there. The acuteness of the symptoms subsided after about a week, but she continued to suffer from pain, and the mass was still present. She also had occasional exacerbations of pain which were not severe. She came to the General Memorial Hospital February 2. At that time there was a large nodular mass which was inseparable from the uterus, and which extended nearly to the umbilicus and was held to the right side; it also filled the lower part of the pelvis. While in the hospital she developed severe pain in the left iliac region and ran an afternoon temperature of 102° F. for a few days. Operation was done February 19. There was found to be a large pus tube on the left side, and on the right side an enormous pus tube which had surrounded the uterus in such a way that it was impossible to distinguish which was the uterus and which was the tube, and blended with them there was a parovarian cyst which extended down between the rectum and vagina. The removal of the uterus

and its appendages seemed the only course which promised success, and this was done. The adhesions were very firm and numerous, and pus escaped into the pelvis in small amounts. This was foul smelling, and inasmuch as its extension into the left tube had so recently caused fever, it probably had considerable infective power. As the patient was in the Trendelenburg posture the intestines were out of the way. The pus was caught on pads, the pelvis was wiped as dry as could be, but no irrigation was used. No drainage was used excepting a piece of gauze, which ran into the vagina from a remnant of the cyst which could not be dissected from between the vaginal and rectal walls, and another beside it which led to the cut edges of the vagina above. Recovery took place without incident, and the patient is now in good condition twenty-two days after operation.

Dr. L. W. Hotchkiss referred to the advisability or necessity of introducing gauze drains in different directions into the peritoneal cavity. If one can depend upon the peritoneum to absorb a certain amount of remaining septic products, why should it not be allowed to do so without hampering the ultimate result by introducing drains? Much difficulty may be subsequently experienced in removing such drains. The speaker said that some years ago, before he had adopted his present technique, he had a case of extensive purulent peritonitis in which he packed the cavity in all directions with gauze: the patient recovered, but it required a second surgical operation to remove the gauze. Dr. Hotchkiss said that for the past year or two, in these cases of appendicitis with free pus in the peritoneal cavity, he has abandoned the use of extensive drains in favor of the method employed by Morris in dealing with similar cases, *i.e.*, removal of the appendix, disinfection of the field with peroxide of hydrogen, washing out the pelvic cavity, if there is free pus, with a sterile salt solution, and the introduction of a small gauze drainage wick surrounded by rubber tissue into the pelvis, which is removed in from twenty-four to seventy-two hours. By this method these patients, as a rule, make an excellent recovery, and there is no gauze left to give rise to difficulty later on.

Dr. Dowd said that in the first case he presented there were four rather small pieces of gauze put in. One was placed over the stump of the appendix, which he thought was necessary. A second piece was inserted into the pelvis which contained foul

smelling pus. The remaining two he did not think were necessary, and he would omit them in similar cases in the future.

SUPPURATIVE ARTHRITIS OF THE KNEE-JOINT.

DR. JOHN F. ERDMANN presented a boy, nineteen years old, who was admitted to the Gouverneur Hospital on account of an enlargement of the right knee-joint, with effusion. His temperature, at the time of his admission, was 102.5° F. An aspirating needle was first introduced, and a quantity of yellow fluid withdrawn. On the following day, as the temperature still persisted, the joint was opened and washed out with salt solution, and drainage was made for forty-eight hours with a tube into the joint. The pus removed from it was submitted to Dr. E. K. Dunham, who reported that it contained a large number of streptococci. The scar on the outer side is the site of an exploration of the shaft of the femur, as there was great thickening in the lower half of the thigh at the time of drainage of the joint. This thickening was suspected by him to be due to a periostitis or an acute osteomyelitis. A section three-quarters of an inch square was chiselled out of the femur to its medullary canal. No pus being found, the wound was closed without drain. Recovery was uneventful. The boy, who is a professional dancer, has been able to resume his work, the function of the joint being unimpaired.

THE LEUCOCYTE COUNT IN SURGERY.

DR. THEODORE DUNHAM read a paper with the above title, for which see Vol. xxxi, p. 669.

DR. CURTIS said that his own experience with pathologic examinations of the blood as an aid to surgical diagnosis had given rather contradictory results. In some fifty cases at St. Luke's Hospital where the blood-count had been made, only general conclusions were arrived at. As a rule, suppuration existed in those cases of surgical conditions where leucocytosis was present, and yet certain suppurative cases did not show any leucocytosis, and its absence could not be explained. In one case of acute appendicitis in a boy, for instance, there was absolutely no leucocytosis before operation; immediately afterwards the patient developed the ordinary operative leucocytosis. A rapid increase in the number of leucocytes was usually noted after an operation, although in very septic cases they began to fall at once after the

operation. In another case admitted with symptoms of acute appendicitis, an adult, there was no leucocytosis whatever. The patient's temperature was 102° F. On the following day his temperature had fallen to normal, and, as all the symptoms disappeared except the tumor, the question arose whether the case was not one of malignant growth in the neighborhood of the ileocæcal valve. An operation disclosed an extraperitoneal abscess in the appendical region, containing a couple of drachms of very thick, dark colored pus, thus verifying the original diagnosis, and showing the uncertainty of our dependence upon the single symptoms of leucocytosis.

Dr. George E. Brewer expressed the opinion that sooner or later the leucocyte count would prove of great value in determining the question of suppuration. The speaker said he had resorted to it during the past two years in almost every case where a severe suppurative process was going on, and with very few exceptions the measure had proven of positive advantage as an aid to diagnosis. He recalled one case where he had relied upon it absolutely. The patient lived at a great distance from New York, and his symptoms were so indefinite that a positive diagnosis could not be made. The blood-count showed marked leucocytosis, and relying solely upon that, Dr. Brewer said he visited the patient, operated, and found an abscess which was the seat of his trouble.

The speaker said that at the City Hospital, last summer, a large number of leucocyte counts were made, and in only one instance did it apparently fail. The case was one of hæmatocele following a ruptured ectopic pregnancy, and the increased leucocytosis which was present could not be accounted for until the time of operation, when a ruptured appendical abscess was found complicating the hæmatocele.

Dr. Brewer said that at Mt. Sinai Hospital they have been accustomed to make a leucocyte count in cases of suspected appendicitis, and it has proven accurate in almost every instance. One case came in, however, in which the diagnosis was in doubt. The patient was a boy who had a large tumor in the right iliac region. There was a certain amount of fever, but very slight tenderness. He was examined by a number of the hospital staff, and the majority of them regarded the tumor as a rapidly growing sarcoma in the neighborhood of the ileocæcal valve. A blood-count

showed 15,000 white blood-cells. The abdomen was opened, and the tumor was found to consist of a hard mass, involving part of the ascending colon; this was first regarded as a sarcoma, but it subsequently proved to be an inflammatory exudate surrounding the appendix, which was the cause of the trouble. Thus the high leucocytosis in this case was satisfactorily explained.

Soon afterwards another case of suspected appendicitis entered the hospital. There was increased leucocytosis. Operation revealed a large lympho-sarcoma of the small intestines, but apparently no pus whatever. Upon opening the tumor, however, it was found to be perforated by a fistulous tract which communicated with an abscess in the centre of the growth.

REVIEWS OF BOOKS.

Traumatic Separation of the Epiphyses. By John Poland, F.R.C.S. London: Smith, Elder & Co.

This is a large volume of nearly 1000 pages, beautifully printed and illustrated by 337 illustrations and skiagrams produced in the very best style, and is a compendium of all that is known on the subject of Separation of the Epiphyses. The literature of America as well as continental nations has been carefully searched and added to our own, and therefore we have a completeness which is seldom found in English works on medicine. This volume is, however, no mere compilation. The pabulum culled from literature has been thoroughly sifted and digested by one who has made a complete study of the subject, and who has spent a considerable time in gaining personal experience, which he has been able in this volume to place at the service of others. The anatomical and pathological observations are particularly good; some of them are original, and all of them are worthy of careful consideration. The Röntgen ray has been made use of to advantage, and especially in the Skiagraphic Atlas which accompanies the volume, and which shows very strikingly the development of the bones of the hand and wrist. This, the author says, is the work of Mr. William Webster, and does him credit.

Without going into great detail, it would be impossible to give an adequate idea of the manner in which the author treats the subject. As a text-book and work of reference it ought to be in the hands of every surgeon, and we cordially congratulate the author on the success of his efforts.

John A. C. Macewen.

DISEASES OF THE NOSE AND THROAT. By J. PRICE-BROWN, M.B., L.R.C.P.E., Laryngologist to the Toronto Western Hospital, etc. Pp. 471. Philadelphia: F. A. Davis Company, 1900.

In a review of this work, one is impressed with the interesting way in which the author has so completely dealt with his subject. For purposes of convenient classification, three main divisions are recognized, namely, I. Diseases of the Nose; II. Diseases of the Pharynx; III. Diseases of the Larynx.

These, of course, have their proper subdivisions.

In the commencement of each section a small amount of space is given to a *résumé* of anatomical and physiological considerations.

After a thorough description of the numerous implements which constitute the armamentarium of a rhinolaryngologist, and after illustrating their proper methods of use, the author systematically presents an excellent treatise on the many pathological affections to which the throat and nose are liable, giving special consideration to bacteriological and other modern methods in relation to etiology and differential diagnosis.

His treatment, both medicinal and surgical, is, in every instance, of the most approved form, and that which is generally recognized and practised by most of our own advanced workers in this branch of medicine and surgery, there being, however, many original therapeutic hints of undoubted value.

The text is clear, the illustrations are instructive and artistic, and the literary tone is of the highest character.

The book should be received kindly by the profession at large (for whom the author especially intends it), and enthusiastically by those who have a selective interest in this branch of medico-surgical science.

WALTER A. SHERWOOD.

THE BEST METHOD OF COLLECTING THE URINE FROM THE URETERS FOR DIAGNOSTIC PURPOSES.[1]

By MALCOLM L. HARRIS, M.D.,

OF CHICAGO,

PROFESSOR OF SURGERY IN THE CHICAGO POLICLINIC.

Although numerous methods and devices have been invented during the past few years for collecting the urines directly from each kidney separately, they may practically all be discarded to-day with the exception of two. These are the ureteral catheter and the urine segregator. The former of these is a direct outgrowth of the cystoscope, an instrument which has furnished such valuable information in the diagnosis of conditions of the urinary tract. To see the ureteral opening at once inspired the thought to introduce the ureteral catheter, and inventive ingenuity soon provided the way for the fulfilment of this desire. The segregator takes advantage of the anatomic fact of the separateness of the ureters as they enter the bladder, and by mechanically prolonging them to the exterior of the body segregates the urines into separate vials.

Because these two methods are so radically different, it does not necessarily follow that they are antagonistic, or that the one must displace the other. It is quite possible that each may have distinct advantages, thereby rendering it specially applicable to particular conditions, and it will therefore be proper to inquire into the merits and demerits, the advantages and disadvantages of each. In dealing with catheterization of the ureters no attempt will be made to define the advantages claimed for any particular instrument, as, for instance, Nitze's,

[1] Read by invitation before the American Association of Genito-Urinary Surgeons, Washington, D. C., May 2, 1900.

Casper's, Brenner's, or Albarran's, or the Kelly method, but the principle of catheterization alone will be considered. Intimately associated with the use of the ureteral catheter for drawing off the urine is the use of solid ureteral bougies or sounds. However, the use of ureteral bougies or sounds, either for diagnostic purposes or as an aid in certain operations, does not properly come under the subject for discussion.

That information of great diagnostic value may be obtained by collecting the urines directly from the kidneys no one will deny who is familiar with diseases of the urinary tract; however, the simplest, most reliable, and least harmful method of accomplishing this end is a subject well open to discussion.

In considering catheterization of the ureters it is found that certain conditions in the patient are essential in order that the procedure may be successfully practised. The first of these conditions is an unobstructed urethra of sufficient size to permit the introduction of the instrument; second, the bladder must have a capacity and tolerance for 120 to 150 cubic centimetres of fluid; third, the fluid must remain transparent a sufficient length of time to permit the catheter to be introduced. These conditions apply equally to all uretero-cystoscopes. To the Kelly method, however, which is practical only in the female, conditions two and three do not apply. Condition one is so self-evident that it requires no comment.

The capacity and tolerance of the bladder or condition number two may vary greatly, particularly when this viscus is the seat of inflammatory changes. In chronic cystitis the bladder may be so contracted that sufficient fluid cannot be introduced to permit the necessary manipulations of the instrument, or the irritability may be so great that the organ will not tolerate the fluid. In the latter case, the intolerance may be overcome by anæsthesia, local or general.

As the catheter is introduced into the ureteral opening by the sense of sight, it is evident that the media must be transparent enough to permit the passage of sufficient light for distinct vision. The transparency of the fluid is most frequently interfered with by blood and pus. The bleeding may come

from the bladder wall or the kidney, and may be so profuse as to cloud the fluid before the ureteral opening can be found and the catheter introduced. An irrigating instrument, by which the fluid can constantly be changed, will do much to overcome this obstacle. Even when the three essential conditions are present, there may still be intravesical obstacles to the introduction of the catheter. Thus, Willy Meyer says (*Medical Record,* 1898, Vol. li, p. 613) "the method may prove unsuccessful owing to the fact that the mouths of the ureters cannot be found, or that they cannot be approached, or that they are too small to allow the entrance of even the finest of catheters."

Extravesical conditions, such as displacements or tumors of the uterus, may so distort the base of the bladder as to render the introduction of the catheter impossible. I saw one of the most expert ureteral catheterizers of Europe fail owing to the presence of a medium-sized myoma of the uterus. Even when the end of the catheter engages properly within the ureteral orifice, it may be impossible to introduce it any distance, and Albarran says (*Traite de Chir. Clinique et Operative,* 1899, Vol. viii, p. 616) "in certain patients no skill will succeed." Israel (*Verhandlung der Berliner medicinische Gesellschaft,* 1899, S. 16) mentions a case in which Casper, after repeated trials, failed to introduce the catheter but a few centimetres, although the autopsy showed the ureter free and able to receive a sound throughout much larger than had been used by Casper.

After the catheter has been successfully introduced a sufficient distance, the urine may still fail to flow, as the eye of the catheter may become occluded by thickened pus picked up in the bladder or met with in the ureter, or by blood-clot, the result of hæmorrhage excited by the introduction of the instrument, or by blood or pus descending from the kidney. Casper (*British Medical Journal,* 1898, Vol. ii, p. 1412) says the introduction of the catheter may provoke spasm of the ureter with complete oliguria, not a drop of urine flowing through the catheter. The ureter may fold over the end of the

catheter and obstruct the flow as mentioned by Albarran. These are some of the obstacles that have interfered with the success of the method in the hands of the most expert ureteral catheterizers, while, in the hands of the ordinary one, the failures, through lack of dexterity and sufficient training, are very numerous. That the percentage of failures, even in the hands of experts, is comparatively large is shown by the very instructive report of F. Tilden Brown (ANNALS OF SURGERY, 1899, Vol. xxx, p. 661). He says, "Of the fifty-five cases there were two males where the conditions were such that no attempt was made to pass urine collecting instruments. In eight other cases (five males and three females) the attempt to collect separate urines failed completely." Excluding the two untried cases, we have eight failures in fifty-three cases, or 15 per cent.

Turning now from the mechanical part or introduction to the results, we find here other sources of inaccuracy. While theoretically ureteral catheterization should give a perfect sample of the kidney's work, practically this is not always true. A certain amount of blood in the urine collected is the rule. Holscher says (*Münchener medicinische Wochenschrift,* 1897, Vol. xliv, p. 1431), "Blood almost always appears in the urine, due to injury to the ureter." Casper says (*British Medical Journal,* 1898, Vol. xi, p. 1412), "A slight mechanical lesion cannot occasionally be avoided," and "Very slight bleeding may occasionally be observed." Again he says (Hollander, *Berliner klinische Wochenschrift,* 1897, Vol. xxxiv, p. 740), "In 50 per cent. of healthy cases blood appears, being due in half to direct injury to the mucous membrane and in the other half to the initial stage of a foreign body ureteritis." Willy Meyer says, "A certain amount of blood in the urine is the rule." All writers of experience agree that a certain amount of blood in the urine must be disregarded.

In addition to the blood, epithelial cells from the ureter are found in the urine. Holscher says (*loc. cit.*), "In all cases the urine contains a large amount of epithelial cells, scraped from the ureters by the catheter, to which no diagnostic importance can be attached." In view of the common presence of blood

and epithelial cells in the urine, due to the trauma incident to the introduction of the catheter, he says, "No conclusions could be drawn of an affection of the ureter or kidney."

Discarding the urine that first collects does not insure blood-free urine, as I have known blood to still show after the catheter had been left in place several hours. Nor is it possible to escape the blood by passing the catheter still farther up the ureter, as has been advised. One of the most important points to be learned from collecting the urines separately from the kidneys is the "functional capacity" of the probably healthy organ. In order to estimate this with approximate accuracy, it is necessary to collect all of the urine secreted by the organ in a given time. It has been observed that all of the urine does not pass through the ureteral catheter, but some of it is carried past the instrument by the peristaltic action of the ureter and emptied into the bladder. Willy Meyer says (*loc. cit.*), "I have distinctly seen jets of urine at the ureteral opening enter the bladder with the ureteral catheter *in situ*. The urine evidently often drains alongside the catheter besides passing through its lumen." Holscher (*loc. cit.*) says the presence of the catheter in the ureter may cause a reflex anuria, and cites a case in which the urine flowed for five minutes from each ureter, then stopped, and not a drop came for forty minutes. These facts make it necessary to accept with caution the estimate of the "functional capacity" based upon the amount of urine that flows through the catheter in a given time.

In addition to the obstacles and sources of error above mentioned, associated with ureteral catheterization, there is one other point that needs consideration, namely, its dangers. The chief danger consists in the carrying of infection to an ureter or kidney which is healthy. However slight this danger may be made to appear, all writers on the subject, without exception, acknowledge it as a possibility, and since the possibility, in more than one instance, has become an actual fact, the necessity of restricting the use of the procedure in certain cases has been recognized. Casper says (*loc. cit.*), "I advocate the greatest possible precaution and care in practising this

method, as in every case the possibility of an infection must be conceded." To indicate how strongly he is impressed with the danger of infecting the ureter, he recommends irrigating the ureter with a solution of nitrate of silver after catheterization. Israel (*Verhandlung der Berliner medicinische Gesellschaft,* 1899, S. 16) mentioned two cases of infection of the kidney; and, although this statement brought on a heated discussion between him and Casper, I think one who follows out the arguments in full must admit that, so far as this point is concerned, Israel maintained his claim. Hollander (*Berliner klinische Wochenschrift,* 1897, Vol. xxxiv, p. 740) mentions a case of right-sided kidney tuberculosis with previous healthy bladder in which, after catheterization of the ureter, a tubercular ulcer developed on the ureter papilla. Denos (*Soc. Fran. d'Urologie,* October, 1898) reports four cases of infection following ureteral catheterization, one of which ended fatally on the third day. Wagner says (*Handbuch der Therapie Innerer Krankh.,* Vol. vii, S. 263), "In the presence of cystitis in spite of the most careful irrigation of the bladder, still, infection of the healthy ureter and kidney by means of ureteral catheterization can easily take place. One must therefore, in cases of cystitis, also in bladder and one-sided kidney tuberculosis, limit ureteral catheterization as much as possible, and must, under these conditions, catheterize an ureter from which clear urine flows, only under the most urgent reasons." Posner (*Verhandlung der Berliner medicinische Gesellschaft,* 1899) says, "Tuberculosis of the bladder is an absolute contraindication to catheterization of the ureter." Imbert (*Ann. d. Mal. d. Org. Gen. Urin.,* 1898, Vol. xvi, p. 715) says, "If the bladder is infected while the kidney is still healthy, one should decide on catheterizing the ureter only with the greatest circumspection." Winter says (*Zeitschrift für Geburtshülfe und Gynäkologie,* 1897, Vol. xxvi, p. 497), "The indications for catheterization of the ureters must naturally be drawn much closer than for cystoscopy, because the procedure occasionally, namely, in diseased bladders, can lead to infection of the ureter and kidney pelvis."

The danger of infecting a healthy kidney, when the bladder is already septic, is recognized as so great that the method is condemned in this class of cases except under the most urgent necessity. But it is in this class of cases that it is so desirable to know to what extent, if any, the kidneys are already involved, and, as is well known, one is unable to tell the origin of pathologic products by their mere presence in the urine. Casper (*loc. cit.*) says on this point: "The quantity of pus, of albumen, or their relations to each other; the reaction of the urine; the form of the epithelial cells, and the so-called 'Pfröpfe,' give us absolutely no support for diagnosis," as they may all be just the same in cystitis or pyelitis. It is often impossible to accurately differentiate between these two conditions without collecting the urines directly from the kidneys; consequently, in this class of cases many patients will be submitted to the danger of infecting a normal kidney from an infected bladder if the ureteral catheter be used.

Turning now to the urine segregator, we find the conditions essential to its use are much the same as those for the cystoscope. Thus, the urethra must be of sufficient size to permit the introduction of the instrument, which is equivalent to No. 24 of the French scale. The bladder must be large enough to allow the instrument to be opened within it. This may be expressed by a capacity of about 150 cubic centimetres. As the sense of sight is not used to locate the ureteral orifices, the third condition mentioned under the use of the cystoscope, namely, transparency of the fluid used, does not apply to the use of the segregator. Conditions within the bladder, such as folds of mucous membrane, etc., which rarely make it impossible to locate the ureteral orifice and introduce the catheter, would not interfere with the use of the segregator. Large fungous growths that bleed profusely on touch may prevent the use of the instrument, but the same will usually interfere with catheterization as well. Small growths need not interfere with the successful use of the segregator. In hypertrophy of the prostate, where the enlargement is unilateral, so as to distort the base of the bladder; where the trigone is so thickened that

it cannot be elevated to form a septum, or where a so-called middle lobe projects into the bladder, the segregator can seldom be satisfactorily used, while, perhaps, in the most of these cases the ureter can be catheterized. In that condition, however, of pouching of the base of the bladder above a prostatic obstruction, such as Brown (*loc. cit.*) describes, in which he was unable to enter the ureter with any instrument, I would expect the segregator to overcome the difficulty, although I have not had an opportunity to try it in just such a case. Conditions external to the bladder which displace and distort that organ may interfere with the segregator as well as with catheterization.

Let us consider now the clinical results obtained by the use of the segregator when used in cases properly within its scope. The first point which presents itself for discussion is the septum. Can this be relied upon to accurately divide the urines so there shall be no intermixture of the urine from one side with that from the other? The reliability of the septum may be demonstrated in three ways:

(1) The use of the instrument in cases where but one kidney is known to be present, as, for instance, after one kidney has been removed by operation.

(2) In simple uncomplicated unilateral renal hæmaturia, and

(3) Where the findings have been proven by operation or autopsy.

Cases of the first class are of value for the purpose of demonstration for the reason that the appearance of any urine whatever in the vial on the side corresponding to the one from which the kidney had been removed would show at once, anomalies excluded, that the septum was not perfect. I have demonstrated the reliability of the septum in such cases in both the male and female. Cases of the second class form beautiful demonstrations. The contamination of the normal, clear urine from one side by the slightest amount of the bloody urine from the opposite side would become at once apparent. I have examined two such cases: One a young man, aged

thirty, in the practice of Dr. McArthur, and the other a man about thirty-five years old, in the practice of Dr. Hooper. In both of these cases the bleeding, which was very profuse, came from the left kidney. The urine from the right side was normal, perfectly clear, and free from blood. A beautiful demonstration in each of these cases of the efficiency of the septum. Of the third class, I have had numerous cases. A few illustrative cases will be mentioned.

Mrs. P., aged forty, examined for Drs. Watkins and Danforth. She had had a vesico-vaginal fistula made some time previous to drain an inflamed bladder. Pyonephrosis of the right side was then diagnosed and a large pus sac drained through the loin. A urinary fistula persisted in the loin, and the examination was made to determine how much, if any, urine from the right kidney came by way of the bladder. The examination showed clear, normal urine from the left kidney, and none whatever from the right. At the operation which followed, the right ureter was found impervious.

I examined for Dr. F. Henrotin a woman who presented a small tumor in the right side of the abdomen just below the costal arch, the exact nature of which appeared doubtful. The left kidney furnished clear, normal urine, while none whatever came from the right side. The tumor was, therefore, referred to the kidney. At the operation, a pyonephrosis was found, with a large calculus completely occluding the ureter at its upper end.

Mrs. L., aged thirty-nine, had been operated on three years before, and a stone weighing 120 grains removed from the left kidney. A discharging fistula remained. Two or three attempts had been made to induce the fistula to close by operation, but unsuccessfully. She then came under my care, and by the segregator were collected in twenty minutes twenty-seven cubic centimetres of clear acid urine from the right kidney and none from the left. At the operation, all that remained of the left kidney were several abscesses, with much tubercular granulations and old cicatricial tissue. Small masses of tuberculous kidney tissue were found embedded in the general mass, all of which was with great difficulty removed.

Mrs. B., aged forty-three, presented a tumor in the right side of abdomen which had given her trouble for some years, but

which had become much worse during the past three weeks. With the segregator, clear, normal urine was obtained from the left side, and absolutely none from the right. At the operation I removed a tuberculous kidney containing multiple abscesses and a large dilated pelvis forming a large pus sac. The ureteral opening at the pelvis was entirely occluded, so that nothing passed along this canal.

Mr. H., aged thirty-seven, presented a tumor in the right side of the abdomen which had given him trouble for about three years. History of vesical irritation, pyuria, pain, etc. Recently the trouble had much increased following an acute gonorrhœal infection. Tumor had enlarged considerably, and fever, chills, and emaciation were prominent features. With the segregator in twenty minutes there were obtained fourteen cubic centimetres of clear acid urine, containing 2.3 per cent. of urea and a trace of albumen from the left kidney. No urine whatever from the right side. At the operation I removed a tuberculous kidney containing multiple abscesses, and surrounded by large perinephritic abscesses. The kidney, as a secreting organ, was practically destroyed, and there was no open communication with the ureter.

In all of these cases an operation demonstrated absolutely the correctness of the results as obtained by the use of the segregator. They likewise prove the reliability of the septum, for, had the smallest amount of urine passed over the septum, it would have appeared at once in the vial corresponding to the diseased kidney, which the operation showed in each case was furnishing no urine. It is not denied that it is possible for the urines to intermix during the use of this instrument, but when this occurs, it is due to a disregard of simple instructions. It may occur by adjusting the instrument so that the septum is raised too high and too far away from the catheters, or from pushing the instrument too far in the bladder. This is always the result of gross carelessness, as each instrument is indelibly marked exactly where the clamps should be placed fixing the lever, and any deviation from this is inexcusable. Intermixture may also occur if the shoulders or body of the patient be raised so that the base of the bladder slopes towards the internal orifice of the urethra. The hips should always be as

high, or even a little higher than the shoulders, so that the slope of the base of the bladder is towards the fundus, and the instrument should always be held so as to slope from within gently upward and outward. It will be seen that these rules are very simple, and, if followed, no intermixture of the urines will take place.

The next question for consideration is: Does the urine as collected in the vials represent accurately the urine as it leaves the ureters, or may it become contaminated by pathologic products formed within the bladder? Upon the answer to this question depends the value of the instrument in differentiating renal from vesical disease. As is well known, it is often impossible to decide, without collecting the urines directly from the kidneys, the exact point of origin of the pathologic elements found in the urine. In all cases where this point is at issue, the bladder should be properly prepared before examination. Recognizing the impossibility of removing absolutely every particle of pus from an inflamed bladder wall by irrigation, I maintain that this can be done thoroughly enough for practical purposes. I use for irrigating a slightly alkaline, normal salt solution. The catheter used should be as large as can conveniently be introduced in order that the flow in and out may be as rapid as possible. This prevents sedimentation of particles detached by the ingoing fluid before they can escape with the outgoing fluid. It is of the greatest importance, in cleansing a bladder for this purpose, to irrigate thoroughly the posterior urethra. I have repeatedly irrigated the bladder until the last drop of returning fluid was perfectly clear, and then found the posterior urethra still filled with pus. In men the prostate should be massaged during the irrigation, so that the subsequent introduction of the lever may not press out any pus to find its way into the bladder. With these simple precautions, the bladder can be so cleansed as not to contaminate the urine in its passage from the ureteral opening to the catheter. Besides, it should be remembered that the urine comes in contact with but an extremely small portion of the bladder wall, and but for an exceedingly short interval of time, passing

almost instantly from the ureter into the catheter. A few illustrative cases are given in support of these statements:

Mr. D., aged thirty-three. Trouble began about four years since with frequent urination and pyuria. General health failed greatly. About one year since an abscess was opened in the right lumbar region. A fistula discharging pus and some urine persisted at this point. At the time of examination, he was passing urine containing considerable pus every few minutes day and night. With the segregator there were obtained in thirty minutes fifteen cubic centimetres of cloudy urine, containing considerable pus and albumen from the right kidney and twenty-five cubic centimetres of clear, light yellow urine, free from albumen and pus, from the left kidney. Right nephrectomy was performed, and the patient recovered. The trouble was a tubercular pyelonephritis.

In the case of Mr. H., already mentioned, nephrectomy for tuberculosis of right kidney, the urine at the time of examination contained a large amount of pus. Notwithstanding this fact, we obtained perfectly clear urine from the left kidney, free from pus. It will be remembered no urine whatever came from the right kidney. Therefore the pus present in the voided urine must have been of vesical origin. Another proof that all the pus in the case of Mr. H., and part of it in the case of Mr. D., was of vesical origin is the fact that after the removal of the kidney the pus in the urine still continued, although both of them soon recovered from their cystitis.

I recently examined for Dr. H. B. Favill, Mr. W., an elderly gentleman, who had constantly some pus in the urine with albumen and casts and, occasionally, some blood. There had been pain in the back, and the presence of a renal calculus seemed probable. With the segregator, we found the urine from both sides free from pus. Both urines contained albumen. That from the left side contained only 1 per cent. of urea, about half as much as the right, and a few hyaline casts. That from the right side contained 1.85 per cent. of urea, more albumen than the left, and numerous granular and a few epithelial casts. Tubes inoculated with these urines remained sterile. The pus was of vesical origin, and our diagnosis double chronic nephritis, the process being in different stages on the two sides with mild cystitis.

Another very interesting case recently examined was that of Mr. C., aged thirty-eight. He had been troubled for about six months with frequent urination, a light irregular fever, and a gradual loss of strength and general health. With the segregator we found that the urine from each side contained a small amount of pus, and numerous epithelial cells, similar to those lining the renal pelvis. There were no casts, but albumen, corresponding to the pus, was present. Inoculations from both urines developed a pure culture of the colon bacillus. We had here, therefore, a double pyelitis, due to an infection with the colon bacillus.

These cases demonstrate that the instrument may be successfully used to differentiate between vesical and renal diseases.

In speaking of ureteral catheterization, it will be remembered it was stated that in about 50 per cent. of the cases slight hæmorrhage was produced by the introduction of the catheter, and a small amount of blood appeared in the collected specimen. The same may be said of the segregator, that it may excite hæmorrhage from the bladder wall, thus contaminating the urines. And this cannot be denied. It is the exception, however, for this to occur when the bladder is healthy, but it is not uncommon for a little blood to appear in the urines when the bladder is irritable or inflamed. This will give rise to no confusion either in the use of the segregator or the ureteral catheter when the urine voided naturally by the patient is free from blood, as it is then very evident that the blood is due to the trauma of the examination. When, however, a small amount of blood is present in the voided urine and it is desired to learn its source, much confusion may result, and a definite conclusion at times is impossible, although an experienced observer will often be able to differentiate between the fresh blood from the bladder wall and that which has been slowly exuded in the kidney, if examined immediately. In those cases in which the bladder is inflamed, and the use of the instrument liable to cause bleeding, I have found the use of a fresh solution of suprarenal extract of great value. The peculiar property of this substance of contracting the blood-vessels

when applied locally to a mucous membrane, thus rendering it almost bloodless, is well known. I introduce from fifty to sixty cubic centimetres of a freshly prepared 5-per-cent. solution into the bladder and allow it to remain from ten to fifteen minutes. This is washed out, and followed by fifteen to twenty cubic centimetres of a 2-per-cent. solution of cocaine, which is allowed to remain about six minutes. A bladder thus treated will stand considerable manipulation without bleeding, and does much towards eliminating the question of hæmorrhage from this organ in these cases, so far as the segregator is concerned. The suprarenal extract, by rendering the bladder wall so anæmic, also diminishes temporarily any secretion there may be from an inflamed mucosa which might contaminate the urines.

An advantage of the segregator is that all of the urine which escapes from the ureters is collected in the vials. None of it is lost. With the ureteral catheter, while the most of it undoubtedly passes through the catheter, some of it may pass around it and thus be lost. While, so far as qualitative analysis goes, this is of no importance, it may be of considerable importance when it is desired to estimate the "functional capacity" of a kidney. Another decided advantage of the segregator is its freedom from the danger of infecting the kidneys. However much we may attempt to minimize this danger with the ureteral catheter, its existence must be acknowledged by all, and it is so great that in certain infections of the bladder its use is interdicted entirely. The segregator may be safely used in these cases without any danger of infecting the kidneys.

It is not intended to convey the idea that the segregator can be used successfully in all cases. I have failed completely in a case of fungous growth of the bladder; in vesical calculi; in some cases of prostatic enlargement; in a case of a large tuberculous nodule occupying one side of the prostate; where the bladder was too much contracted to permit the turning of the instrument; in a case of tuberculous ulceration of the bladder where the introduction of the instrument excited so

much spasm of the bladder that it could not be tolerated, although this last case was before I knew how to anæsthetize the bladder, and the spasm could have been overcome by local or general anæsthesia. I now usually make use of local anæsthesia after the following manner: The bowel is washed out and the following mixture introduced: Antipyrin, one gramme; Tr. Opii, one cubic centimetre; Water, ninety cubic centimetres. This requires about thirty minutes to act, and renders the base of the bladder quite anæsthetic. While waiting for it to act, the bladder is irrigated, and the solutions of suprarenal extract and cocaine used as above described. After this preparatory treatment, the instrument may be used with almost no sense of pain even when the bladder is quite sensitive. Great caution must always be exercised in the use of cocaine in a bladder that is ulcerated or denuded of mucous membrane, as serious toxic symptoms may result.

Many of the critics of the segregator seem to have been imbued with the idea that it was intended to take the place of every other device and method of examination in the diagnosis of diseases of the urinary tract. It has been criticised as unreliable because it would not diagnose an ulcer of the bladder; because with it one could not see a small papilloma or epithelioma of the bladder wall; because it could not be used in certain cases which had already been shown were unsuited to its use; because with it one could not tell the exact point at which a stone was lodged in the ureter, etc.

The segregator is not a cystoscope, nor does it in any way take the place of one. The cystoscope is just as necessary and as useful as ever; but with the cystoscope one cannot collect the urines directly from the kidneys, while with the segregator one can. The use of the one instrument thus often supplements that of the other. The collecting of the urines directly from the kidneys does not make a diagnosis. It but adds one more fact which must be judiciously weighed with all others. In summing up then, we find: That catheterization of the ureters has a field of application which is absolutely distinct, in the sense that no other means at our disposal accomplishes

the same end, namely, to determine the nature and location of obstructions of the ureter; to locate the ends of a divided ureter or as a guide in certain intrapelvic operations; for tapping and draining fluid accumulations in the renal pelvis; for therapeutic purposes, such as dislodgement of calculi, irrigation of renal pelvis, etc.

Catheterization of the ureters simply for the purpose of collecting urine for diagnostic purposes has its drawbacks and limitations, among which may be mentioned temporary anuria, due to the presence of the catheter in the ureter; contamination of the urine with blood and epithelial cells from the ureter; danger of infecting a healthy ureter and kidney. This last-mentioned point is of such a serious nature that catheterization of a healthy ureter, when the bladder is infected, or the opposite kidney tuberculous, has been condemned. If this injunction be heeded, as it should be, it will deny the benefits of this diagnostic aid to a large class of patients.

We find that the segregator likewise has its limitations. There are certain cases above mentioned which are not suited to its use. In certain intravesical lesions its use must be supplemental to that of the cystoscope. But for the differential diagnosis of certain tumors of the abdomen; for determining which kidney is diseased and the "functional capacity" of each, whether the bladder be infected or not; for differentiating between certain bladder and kidney infections, the segregator gives results that are perfectly reliable, as has been repeatedly demonstrated by numerous anatomic findings. Furthermore, in the infected cases it has the advantage over the ureteral catheter of being free from the danger of infecting a healthy kidney.

A CRITICAL SURVEY OF URETERAL IMPLANTATIONS.[1]

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Injuries to the ureters take many forms, varying from the kinked ureter, as a result of twisting of adjacent tissue incident to the pulling of ligatures badly placed, to the unwitting removal of several inches of the organ.

Previous to 1877 there had been but two ways of dealing with a complete section of the ureter. These were the let-alone policy and nephrectomy, as established and practised in 1869 by Simon. And it is very probable that but for the popularity of nephrectomy, ureteral surgery would have had a much earlier elaboration. Quite in contrast with the ruthless destruction of function as represented by nephrectomy in such work is the case of Lange, of New York, in which several operations were done before nephrectomy was done. In this prompt adoption of the expedient of nephrectomy the only kidney has been removed. A case of nephrectomy was done in this country but a few years since in which the only kidney was removed as disclosed by the autopsy and anuria existed twenty-nine days before death claimed its victim.

The severed end of the ureter has been implanted into itself, the bladder, the urethra, the rectum, the colon, the cæcum, the vagina, and even to the skin. The pelvis of the opposite kidney and the opposite ureter as depots have not escaped consideration. Each of these plans of disposal of the functionating ureteral stump has its enthusiastic advocates, though it cannot be said they are alike applicable. These anastomoses are now being made for conditions other than

[1] Read before the American Gynæcological Society, May 1, 1900.

complete sections of the ureter, ectopia vesicæ, tumors of the bladder, requiring its resection or exsection, and abnormal congenital ureteral endings have been the indications for bladder grafting in a number of instances.

Practically all are agreed that for severed ureter without much loss of tissue the best procedure is to unite the severed ends. This has been done by four principal methods, viz., the transverse end-to-end, the oblique end-to-end, the end-in-end, and the lateral implantation or end-in-side. The transverse end-to-end has been done twelve times by Schopf,[10] Hochenegg,[99] Fritsch,[99] Cushing,[99] Tauffer,[99] two cases, Allen,[100] Durante,[101] Gusserow,[102] Busachi,[101] Eiselsberg,[1] and Labisé.[103]. Tauffer inserted into the cut ends of the ureter a piece of ureteral catheter held by a ligature around its middle and removed it just before tying the last sutures. Schopf's and Hochenegg's cases died in forty-two and twenty days, respectively, from conditions independent of the ureteral operation. Allen's case was unique as it occurred in the case of a horseshoe kidney, the removal of which was attempted with the impression that another kidney existed. After the ureter was severed, this mistake was fortunately realized and the cut ends united. He could not make the end-in-side anastomosis as the ureter was too short, and the injury was too high to transplant the upper stump into the bladder. The end-in-end has been done by McMonagle [104] in three cases, in all of which the ureter was dilated. In one of them the patient died of shock. Robson,[99] Winslow,[105] D'Antona,[106] and Markoe [107] have each modified this operation by splitting the lower end, and G. H. Noble, of Atlanta, has practised this modification twice, making nine times the end-in-end has been done with but one death. Markoe employed a ureteral catheter for closing and left it in place five days. The end-in-side implantation has been successfully followed in four cases by Kelly,[99] Doherty,[99] Emmet,[99] and Schauta,[109] and Reynier [108] has lost one case after this operation. The oblique end-to-end has been done but once and that by myself.[99] The patient is still (four years later) perfectly free from

any symptoms referable to the bladder or upper urinary passages. Thus it will be seen the divided ends of the ureter have been directly approximated twenty-seven times with two deaths, and in not one was there failure to unite or subsequent loss of function, although Schopf's tubercular patient had some ureteral dilatation above the site of union. In addition to these we find Seiffart,[110] in removing a broad ligament tumor, accidentally resected a piece of the right ureter. The two ends were approximated and sewed in the abdominal wound. The original distance between them of two centimetres became gradually less, and after four months' union of the ends was continuous. The lower end had been kept patent by daily passing a sound. The function of the ureter after the four months seemed complete. This plan of treatment would seem to be exceedingly faulty, as, with all the granulation process near the cut ends of the ureter, narrowing of the lumen of the duct is almost certain to occur. And it is this result that is most feared in uretero-ureteral anastomosis. It has greatly worried experimenters, and led Van Hook to his unique implantation and myself to the oblique end-to-end plan.

There can be no doubt uniting the ureter ends is by far the best manner of disposing of the divided ureter, whenever it is possible. This method is applicable to the whole extent of the ureter, except practically the lower inch in the male and lower two inches in the female. It is but fair to state that accidental complete section of the canal during pelvic operations frequently occurs in the lower four inches of it.

It is difficult to decide which of the methods of uretero-ureteral anastomosis is, on the whole, the best. Loss of ureteral tissue by clamping or ligating the cut ends or by resecting the duct is a special feature requiring consideration in remedying the dilemma in which the surgeon is placed. In the different plans for uniting the two ends, except the transverse end-to-end, an additional loss of length of the duct is made. In the end-in-side method the loss must be at least one and a half inches. The lower end has to be ligated, and, beginning half a centimetre below the ligature, a longitudinal

slit one centimetre long is made in it. Through this opening is drawn the upper cut end by means of sutures passing outwardly through its wall some distance from its end. These sutures penetrate outwardly through the wall of the lower stump one centimetre below the incision (Van Hook and Kelly). In Robson's case of end-in-end anastomosis he states an inch of the length of the ureter was utilized in the operation, and in my case of oblique end-to-end union the loss was probably three-quarters of an inch. Another element of danger, perhaps over-estimated, because of the results of experimentation on the very small ureter of the dog, is subsequent narrowing of the calibre at the point of union. This is most likely by the transverse end-to-end and next by the end-in-end. In the lateral implantation method of Van Hook, there would be the theoretical constriction due to placing one end in the other, as in the end-in-end method. But this is theoretical, only, so far as operations on man are concerned. In the oblique end-to-end method this feature is obviated. The end-in-end and end-in-side plans are not so applicable if the upper end be dilated more than the lower, as occurred in Emmet's case, and will often result from pressure on the ureter at about the point of section. Were the lower end larger than the upper, a not likely condition, these methods would be especially indicated. The oblique end-to-end, however, is applicable to both these variations as well as to the normal. The slant on the dilated end need not be made at so small an angle with the longitudinal axis of the tube if the other end be normal in size. This permits of accurate approximation. No bad result from a slight angle at the point of union would result, as proven by the Van Hook method. The danger of leakage after operation is very slight, it having occurred in but one case. Theoretically it might follow any of those in which sutures have penetrated the mucosa. Whether the sutures thus passed are quickly covered by mucous membrane or whether cases may be recorded where calculi form after such operation is yet to be learned. Considering all conditions in a given case to which this operation is applicable not much choice exists, except in the

hands of surgeons devoid of usual deftness, when the end-in-end or end-in-side methods are perhaps preferable. And if considerable loss of length of ureter should be a feature, the preferable operation would be the transverse end-to-end, though careful suturing is necessary to prevent leakage. D'Urso and De Fabii [111] have made a number of experiments in making a lateral anastomosis between the two severed ends of the ureter as is done with the intestine. They claim to have been very successful. Monari [47] and Tuffier [47] have recommended the same method to avoid stricture. Generally the ends may be more easily approximated if the attachment of the duct be in part separated for a distance of a few inches above and below the point of section. The cases of Chrobak [47] and Ruhl [47] and the experiments of Margarucci [47] and Monari [47] demonstrate conclusively this may be safely done. Kaysar loosened it as far as the pelvic brim without untoward result.

Uretero-cystostomy.—I find recorded or quoted eighty operations of this kind done by sixty-five different operators. I have not been able to verify a few of these cases by studying the original reports. Probably this operation was first done by Tauffer [43] in 1877, he having accidentally cut off a ureter during an abdominal operation for the removal of a broad ligament cyst. He then successfully transplanted the proximal divided end into the bladder. This was eight years after Simon had done nephrectomy in a case in which some time before the ureter was cut off in removal of a broad ligament cyst. It is to be regretted that Simon's plan is yet resorted to for this indication, as I have learned was recently done in my city. The next operation was by Novaro, in 1893, and nearly all writers on this subject credit this as the first. Uretero-cystostomy is a much easier operation than ureteral splicing, and that it has been so frequently done during the past seven years is partly the result of that. The very large number of cases of uretero-vaginal and other ureteral fistulæ, however, more largely account for the large number of operations.

Of the thirty-seven bladder grafts for injuries of the

ureter during abdominal operations, we find fifteen were done by the intraperitoneal method. All of these were done at the time of injury with one death (Krause's patient), and that not connected with the operation, and two failed. By the extraperitoneal plan two were done. Of a number of other cases I was unable to learn the plan followed. In one failure is recorded. In most of the intraperitoneal operations the peritoneum was carefully closed over the site of the operation, making them nearly extraperitoneal. In twelve of these cases resection of the bladder was done for various conditions. The mortality was but a trifle over 2 per cent.

Of the cases done for various kinds of fistula or other conditions for which an operation was proposed and executed we find there were forty-two, of which twelve were by intraperitoneal operation, fourteen by extraperitoneal, and in sixteen the method was not mentioned. In two cases, those of Lange and Calderini, both ureters were successfully spliced, and in Fullerton's the spliced ureter was double, both parts being successfully grafted. Four died, one of them some time later, probably from pyonephritis, and another from an old chronic nephritis. This operation is indicated when in the course of an abdominal operation section of the ureter in its pelvic portion is made either accidentally or intentionally, splicing of the cut ends being impossible or inadvisable. The lower portion of the ureter may be diseased to such an extent as to demand extirpation or to render it useless, or it may be so short as to render splicing of the ends exceedingly difficult and unsafe. In the cases of Polk, Krause, and myself the ureteral section was elective with removal of the lower segment. Ureteral fistulæ following operations, difficult labor or forceps delivery and abnormal congenital ureteral openings also call for this procedure. The latter condition was the indication in the cases of Baumm, Colzi, Davenport, Albarran, and Benkiser. Ferguson found of sixty-seven cases of ureteral fistula twenty-five were created in parturition, in sixteen of which forceps delivery was performed. In twelve vaginal hysterectomy was the cause; two by stone in the ureter and ulceration, three by

abdominal section; one had a traumatic origin, two from pelvic abscess; one from a pessary, one spontaneous, probably tubercular, necrosis of the ureter, as in Krause's case and marked undilatable stricture of the lower end, as was one of Israel's cases. In but a few of the uretero-vaginal fistulæ can cure be procured by vaginal plastic surgery. The danger of relapse from heavy strain from cicatricial contraction is too great to permit this plan to be adopted in any but the most favorable cases. The methods of bladder grafting of the ureter are principally by the abdominal route. Colzi in one case severed the genital organs on one side from the pubes, cut away part of the lower portion of the pubic arch and transplanted an abnormally ending ureter into the bladder, and Baker, Davenport, and Benkiser, operating from the vagina, severed the ureter above the fistula and transplanted into the bladder. These operations are very difficult, and Colzi's procedure in the light of our present knowledge of ureteral surgery will scarcely be repeated. The abdominal route is far superior for vesical anastomoses with the ureter. By this route the splicing may be done by the intraperitoneal or the extraperitoneal method. When possible, the extraperitoneal will naturally commend itself. As pointed out by Martin, suturing the peritoneum tightly over the ureter endangers subsequent constriction of the ureter. Veit has modified the extraperitoneal method by bringing the cut proximal end up to the abdominal incision and suturing it there, and then by bringing bladder up extraperitoneally to meet it, anastomosis was made. Various modifications of both the intra- and extraperitoneal methods have been made to meet the given conditions.

The principal methods that have been employed are those of Witzel,[91] Veit,[49] and the so-called Fritsch-Kelly,[96] all extraperitoneal practically, though in the two former the peritoneal cavity is opened as a preliminary step. Baumm has also done a purely extraperitoneal grafting of the bladder by a suprapubic incision. Baker [75] also did a vaginal extraperitoneal graft of ureter into bladder successfully. There can be no question but

exposure of the peritoneal cavity should be avoided whenever possible in making these anastomoses, and particularly is this important if the ureter or bladder be diseased or conveying abnormal urine; but in the class of cases in which the ureter is injured during the progress of an abdominal operation we cannot draw such fine lines. A considerable interest has been manifested in the manner of attaching the ureter to the bladder. Pozzi found a marked distention of the ureter ten months after the operation, which he attributed to reflux of urine from over-distention of the bladder, and Polk found the same condition resulting from constriction at the point of union. An effort has been made to imitate the normal oblique bladder implantation of the ureter to prevent reflux, and splitting of the end of the implanted ureter has been employed to prevent constriction. In quite a number of cases the operation failed from lack of union, generally due to too great tension on the tissues of both ureter and bladder. This has been overcome in a few cases by means of traction sutures placed in the end of the ureter in the bladder and brought out through the urethra, where they were sutured to the end of the urethra (Krause) or attached to dressings. In one case (Kaysar) the sutures were weighted for five days with 200 grammes. All these were successful. Kelly and others have stitched the bladder higher in the pelvis to broad ligament or other structures to prevent downward traction on the sutured junction. To me this is a better plan than weighting the end of the ureter, as there will be less tendency to narrowing the junction by future tension.

The fact, as shown by the statistics, that a few cases have leakage would seem to make drainage a necessity. Martin, of Berlin, however, believes drainage dangerous, as preventing rapid union by causing too much irritation. But to allow an escape of urine without affording it an outlet seems contrary to surgical principles.

It is impossible to make an anastomosis between ureter and bladder as good as the natural one, because the small muscles attached to the ends of the ureters and lost in the wall of

the bladder near the internal meatus cannot be utilized. Their function is to draw down the orifice of the ureter when the bladder distends, thus preventing loss of obliquity of that duct through the distended bladder wall. Of course this same disadvantage accrues in all forms of implantation of the lower end of the ureter, except, perhaps, in the plans of Maydl and the Italian surgeons, Pozza and Capello, in rectal grafting of it, in which a small portion of it is retained with the ureter ends. The plan of Boari [22] does not convey to me any advantages. He has applied it in rectal and bladder transplantations of the ureter in animals, and in bladder anastomosis once successfully on a man, and Casati once with a fatal result in thirty-five days. The importance of careful surgical technique is here very greatly emphasized, as a slight infection may render the operation unsuccessful and endanger ascending infection along the ureter.

Whenever the ureter requiring grafting is above the brim of the pelvis and ureteral anastomosis with itself or the bladder seem impossible, its implantation into its fellow is to be considered. If this be decided impracticable, then loosening and downward displacement of the kidney, thus far done only experimentally, may be employed to permit these anastomoses. Should these be found impossible, then grafting into the bowel will be justifiable. As double ureter is occasionally met with as well as anuria of the affected side, we should have these in our minds and deal with them accordingly.

The only case of the kind that has occurred in my practice was in a woman fifty-two years of age operated, April 4, 1898, for cancer of the uterus. A wide abdominal hysterectomy was done, removing as much of the ligaments as possible after isolating the ureters. The upper half of the vagina was dissected away from above, and the specimen thus loosened was withdrawn from below. In following the left ureter towards the bladder it was found slightly dilated and passing through a mass of cancerous infiltration. It was ligated at its junction with the bladder, cut away at this point as well as above the cancerous mass mentioned, and the piece, about two

inches in length, removed. A small opening had been made in the bladder during the separation of the uterus and vagina from it, and through this a pair of forceps was introduced and made to return through another opening made to receive the ureter end. They now grasped the ureter end, pulled it into the bladder, and held it while it was carefully sutured to that viscus by means of fine catgut. The forceps were withdrawn and the accidental bladder wound closed. The peritoneum from behind and that covering the bladder were sutured, closing the peritoneal cavity. The abdominal wound was closed and the wound lightly packed with gauze from the vaginal side. A small nick with the scissors had been made in the ureter an inch above the junction, but it was not thought to enter its canal. The whole operation lasted three hours. Permanent catheterization was not satisfactory, and frequent use of the catheter had to be employed instead. April 11, slight discharge of urine from the vagina appeared, and continued to May 5, when it stopped for a few days to again reappear. Specular examination of the bladder showed urine coming into it from the right ureter and from a point high to the left, thought to be the left ureteral opening. With the exception of the slight discharge of urine from the vagina she was feeling excellent, and was voiding from thirty-six to fifty ounces of urine daily. I was in doubt as to whether the union of ureter and bladder was incomplete or the leakage was from the injury to the ureter higher up. Having waited for a possible return of cancer, I finally yielded to the wish of the patient and operated to close the abnormal urinary opening November 14, 1898. Upon opening the abdomen a mass of adhesions was found in the region of the ureteral injury. A small probe passed into the bladder was easily made to pass into the ureter, and the slight opening in it was found to be connected with the bladder and vagina by a Y-shaped fistula. The bladder opening was probably in the line of the suturing to close the wound accidentally made during hysterectomy. As the uretero-vesical opening seemed too narrow, it was thought advisable to remove the portion of the ureter below the fistula, which was done and

uretero-cystostomy repeated. The vaginal portion of the fistula was enlarged, and in it placed a narrow strip of gauze. This was kept in place with occasional changing until danger of leakage was passed. She made an excellent recovery, and now weighs more than 200 pounds, which is evidence of no return, thus far, of the cancer.

CASES OF BLADDER IMPLANTATION OF URETER FOR URETERAL INJURIES DURING ABDOMINAL OPERATION.

(1) Tauffer.[42] In removing a broad ligament cyst accidentally cut off the ureter, and successfully transplanted it into the bladder, intraperitoneally.

(2) Westermark.[44] Did a successful transperitoneal graft.

(3) Dunning, L. H.[45] Injured ureter during removal of an abscess from the pelvic structures; transperitoneal implantation into bladder; success.

(4) Matas, R. (personal communication). In removing a large fibroid of the uterus, in 1895, found urine spurting from a completely severed ureter, one and a half inches from bladder; successful intraperitoneal bladder graft.

(5) Lannelongue.[46] [47] An unsuccessful bladder graft of the ureter.

(6) Israel, James.[48] Extraperitoneal bladder graft for stricture of ureter; fistula resulted, requiring a second operation; successful.

(7) Veit.[49] Did an extraperitoneal operation by bringing severed ureter out of abdominal incision at point where it passed abdominal wound, where it was fixed by two sutures between fascia and peritoneum; skin incision carried to symphysis and bladder opened extraperitoneally on anterior surface; ureter cut obliquely and sutured into bladder; recovery.

(8) Pozzi.[50] Injured ureter during operation and grafted into bladder; nine months later did herniotomy and found ureter the size of femoral artery, which he considered due to reflux from bladder when urine was held too long.

(9) Schwartz.[51] Case of transperitoneal graft of ureter in bladder; recovery.

(10) Baldwin.[52] Operation for sarcoma of fundus uteri; cut out one and a half inches of ureter; could not make uretero-ureteral anastomosis, as loss was too great; did bladder graft and, as tension was great, sutured bladder to broad ligament; recovery.

(11) Baldy.[53] Ureter embedded in inflammatory tissue; it was severed and grafted into bladder intraperitoneally; success.

(12) Penrose.[54] Cancer uterus, abdominal operation, lower portion of ureter involved and resected; grafted successfully into bladder.

(13) Krug.[55] Same as Baldy's; success.

(14) Delageniere.[56] A successful case.

(15) Füth.[57] A successful case.

(16) Polk.[58] Same indications as case of Penrose; return of disease, and secondary operation, at which he found ureter dilated, as the duct was too much constricted at lower end.
(17) Fullerton.[59] A successful case of grafting a double ureter.
(18) Graupner.[60] Same as Krug's; transperitoneal; successful.
(19) Lotheissen.[47] Same as Krug's; transperitoneal; successful.
(20) Veit.[49] Operation on adnexa; bladder graft; successful.
(21) Olshausen.[49] Operation on adnexa; bladder graft; successful.
(22) Podres.[61] Operation on adnexa; bladder graft; successful.
(23) Hanks.[62] Transperitoneally; one case; successful.
(24) Noble.[63] An unsuccessful intraperitoneal operation.
(25) Wertheim.[64] Operation, May 30, 1899, for intraligamentary uteromyoma; accidental severing ureter; implanted into bladder by means of a sling and knotted silk sutures; success.
(26) Israel.[48] Resected bladder for cancer and removed lower end of ureter, implanted stump at a new place; recovery.
(27) Schuchard.[65] For bladder resection; success.
(28) Poppert.[66] For bladder resection; success.
(29) Krause.[46] For bladder resection; died.
(30) Westermark.[66] For bladder resection; success.
(31) Albarran.[67] For bladder resection; success.
(32) Verkoogen.[68] For bladder resection; death in two hours.
(33, 34) Küster.[69] For bladder resection; two cases.
(35) Bardenheuer.[70] For bladder resection; success; patient died five months later from other trouble.
(36) Wertheim.[64] Operation, December 5, 1895, for papilloma of bladder and involvement of left ureter; removal of tumor, part of bladder wall, and ureteral orifice; implantation ureter into the bladder-hole; death in forty-two days.
(37) Wertheim.[64] Removal of tumor with portion of uterus; seven centimetres of ureter and portion of rectum; leaving stump of ureter two centimetres long; implantation with great difficulty; fistula established by latter July, and death occurred shortly after.

CASES OF BLADDER IMPLANTATION OF URETER FOR URETEROVAGINAL AND OTHER URETERAL FISTULÆ.

(1, 2) Novaro.[71] [72] Did two successful cases for ureterovaginal fistula after vaginal hysterectomy.
(3) Martin, A.[73] Case failed by vaginal route and was successful by the abdominal; extraperitoneal graft.
(4) Kaysar.[74] Thirteen days after hysterectomy urine noticed coming through abdominal incision; cut down and did bladder graft; sutures drawn out urethra and fastened to dressings; flow gradually stopped; catheter à demeure; imperfect result, and operation repeated five months later; for five days fastened a weight of 200 grammes to sutures; success.
(5) Ferguson.[75] Transperitoneal; successful for uretero-abdominal fistula after abdominal operation.

(6) Calderini.[76] Ureterovaginal fistula; transperitoneal graft; success. This case was in both ureters.

(7) Sokoloff.[77] Successful transplantation after forceps delivery.

(8, 9, 10) Bazy.[78] Three successful cases, one requiring a second operation; all for ureterovaginal fistula following vaginal hysterectomy.

(11) Trendelenburg.[79] A successful case.

(12) Boldt.[80] Successful transperitoneal case for ureterovaginal fistula.

(13, 14, 15) Mackenrodt.[81] Three cases by the Fritsch-Kelly method, and the first died from nephritis unconnected with the operation.

(16) Lotheissen.[47] Transperitoneal; success.

(17) Albarran.[82] Abnormal attachment of ureter; successful.

(18) Colzi.[83] Abnormal orifice of ureter in vagina, congenital; incised above and outside labium major, detaching genitals from arch of pubes, cutting away some of the bone from the lower surface of arch to reach base of bladder; abnormal ureter cut across and sutured into place; success.

(19, 20) Rouffart.[84] Two cases transperitoneal after ureterovaginal fistula; one died.

(21, 22) Bushbeck.[85] Transperitoneally for ureterovaginal fistula; the second failed, and nephrectomy was done.

(23, 24) Tuffier.[86] Two cases done transperitoneally for ureterovaginal fistula.

(25) Routier.[87] One successful case after forceps delivery.

(26, 27) Amann.[88] Two such cases; success.

(28) Sänger.[89] One such case; success.

(29) Baker.[75] Extraperitoneal, vaginal, successful.

(30) McMonagle.[90] For ureterovaginal fistula after laparotomy; success.

(31) Witzel.[91] Extraperitoneal; vaginal had failed; success. His method is as follows: The bladder was detached and drawn out. The thickened ureter was severed at about the middle of its course through the broad ligament; the lower end closed by sutures, and the upper end brought to the upper part of the incision at the brim of the pelvis, drawn down beneath the peritoneum above the innominate line by a pair of long forceps started upward under the peritoneum. The incisions in the pelvic peritoneum and median line of abdomen were closed, and the remainder of the operation done extraperitoneally. The bladder was then brought above the middle of the iliac fossa, where it was fastened with catgut sutures. The obliquely cut ureter was now inserted into bladder incision, the mucosa of bladder and ureter being united by fine catgut and another row outside of it attached to ureteral and vesical walls. An oblique channel through the bladder was formed by uniting the bladder walls over the ureter on both sides.

(32) Davenport.[92] Case similar to Colzi's; success.

(33) Baumm.[93] Same as Davenport's. Accessory ureter opening into urethra; incontinence. Suprapubic, extraperitoneal. Misplaced ureter divided; proximal end in bladder; recovered.

(34) Amann.[94] Another successful case for ureterocervical fistula. Bladder raised by sound and oblique grafting done; success.

(35) Krause.[46] Intraperitoneal (following vaginal hysterectomy); cut off ureter; split the end and spliced into bladder, suture through each lip of ureter brought out and sutured to external meatus urinarius; successful.

(36) Kelly.[95] Ureterovaginal fistulæ after vaginal hysterectomy. Loosened bladder from attachments and spliced; extraperitoneal; success.

(37, 38) Kelly.[96] Ureterovaginal fistula after vaginal hysterectomy; did extraperitoneal operation on wrong ureter, in the first case, by wrong direction of catheter; it failed, and he closed both ureterovaginal fistulæ by vaginal plastic operation. The second was done by the Fritsch method, and the patient died from pyelonephritis (probably).

(39) Lange.[97] Hysterectomy for cancer by another surgeon; pyonephrosis with right nephrotomy nine months later; a month from then median incision and both ureters implanted in fundus of bladder. Silk suture brought out urethra and tied over short piece of drainage-tube. The right failed, and two months, suprapubic cystotomy and successful anastomosis; five months, left pyonephrosis and nephrectomy; success.

(40) Wertheim.[64] Uretero-uterine fistula following removal of ovarian cyst. Operation January 3, 1896, extraperitoneal, changing to intraperitoneal; implantation of ureter into bladder; death in thirty-five hours.

(41) Schauta.[64] Vaginal fistula; bladder implantation; nephrectomy five months later; success.

(42) Benkiser.[98] Supernumerary left ureter opening into vagina; ureterocystotomy; success. This was probably a vaginal operation.

Rectal Implantation.—A very large field for this operation has been developed in the treatment of ectopia vesicæ, benign and malignant growths of the bladder requiring its complete extirpation, of injuries of the ureter irremediable by ureteral or bladder anastomoses, and Chalot has implanted successfully both ureters into bowel during operation for uterine cancer involving bladder in which he ligated the internal iliac arteries, and extirpated both uterus and bladder. It seemed necessary to place rectal graft of the ureter among the justifiable operations, as cases occasionally occurred in which some disposition of the ureter had to be made, and no other alternative but nephrectomy was accessible. The many hundreds of experiments made on animals by Gluck and Zeller, Novaro, Ceci, Bardenheuer, Reed, Van Hook, Tuffier, Chaput,

and a host of others proved unsatisfactory. In fact, like the other methods of ureteral grafting, animal experimentation did not compare at all favorably with the same work on man. This is probably attributable to the much smaller size of the ureter in dogs, the greater difficulty of carrying out asepsis in the operation, and the difficulty of keeping animals quiet during the next few days after operation, so necessary to good union. Inasmuch as the operation has now been done sixty-five times on man, it is certainly not too early to consider its merits and defects. The recorded mortality has been eighteen, or a little less than 30 per cent. But six of them have died from the shock and severity of the operation for the condition calling for the grafting. But in at least seven cases death resulted from five days to two years after operation, from infection of kidney, peritonitis, or other untoward result of the rectal grafting. In five cases the cause of death was obscure. In Tuffier's case, much vaunted as being the first successful complete extirpation of bladder in man, death occurred nineteen months after operation, and he gives no details of the cause. As the operation was done for bladder epithelioma, the fatal result may have been from malignant disease. In two cases the result is not published. When we consider that of deaths from all causes 40 per cent. are from subsequent infection, the suspicion that some of the reported successful cases may also later succumb to infection is certainly reasonable. The high mortality rate of such a procedure must necessarily cause great anxiety as to its justifiability, and were it not for the most excellent work of Maydl, followed so successfully by a number of other surgeons, we might look upon the subject with almost condemnation. However, when we consider that but eight deaths have resulted in the operations done by his method, a mortality rate of but 21 per cent., we readily see the operation has been markedly rid of its terrors. The danger of subsequent kidney infection and peritonitis has been very greatly reduced.

Methods.—Anastomosis between ureter and rectum has been done by five different methods, viz., (*a*) by the formation

of a fistula between them; (*b*) by the axial implantation of the ureter stump into the bowel, and its fixation there by means of the Lembert or the double row suture; (*c*) implantation of both ureters with a piece of the bladder, as by Maydl, Pozza, and others; (*d*) implantation of both ureters with a small amount of the bladder mucous membrane, and (*e*) by means of apparatuses, such as those of Chalot and Boari. Simon did the first operation akin to this subject by passing a loop of thread in such a manner as to cause ulceration between rectum and ureter in a case of ectopia vesicæ. While urine continued to come through exposed bladder, the recto-ureteral fistula remained open. Then Smith, in ectopia vesicæ, implanted the right ureter into ascending colon, and fourteen months later the left ureter into descending, but this proved fatal in twenty-four hours. The autopsy showed not only infection of right kidney, but obstruction at point of anastomosis on both sides. Then Küster, in 1896, failed, with a death from peritonitis and ascending pyelonephritis in five days. Chaput in September, 1892, successfully implanted a ureter for ureterovaginal fistula following vaginal hysterectomy, and at the end of one year there was no evidence of infection. Two months later he implanted both ureters in the rectum three months apart, and death occurred from suppression of urine the day of last operation. His plan was as follows: Make incision through abdominal wall from costal cartilages, about ten centimetres, to side of median line, down to opposite the anterior superior iliac spine, and then curve to two centimetres of median line, the intestines held aside and post-peritoneum incised ten centimetres long in iliac region, and internal flap stripped up to spinal column. Ureter cut between forceps. Inferior portion ligated and replaced. Superior portion held in contact with posterior internal aspect of colon and sutures inserted. Posterior lip ureteral orifice is first fastened to intestine by three or four sutures through muscular layers only. Intestine incised one centimetre several centimetres from preceding sutures. Mucous membrane of posterior flap of the two orifices now sutured, and then anterior lips by row su-

tures through muscular layers; a few extra sutures at end of incisions, then ureter covered over by sero-serous sutures in the intestinal wall.

Fowler makes an incision in the median line, and with patient in Trendelenburg position. The rectum is cleansed; the posterior layer of peritoneum is incised sufficiently to expose the ureters freely. They are traced to their termination on the bladder wall, from which they are detached and their ends cut obliquely; a longitudinal incision of seven centimetres is made in the anterior wall of the rectum through the serous and muscular coats; edges are retracted, making a diamond-shaped space in the exposed submucosa; a tongue-shaped flap of mucous membrane with its base upward is cut from the bowel in the lower half of the diamond. It was doubled upward on itself so that its mucous surface presented anteriorly, where it was secured by one or two catgut sutures, making a flap on both sides covered with mucosa. The ureters are now placed in the incision with their obliquely cut ends lying upon the presenting mucous membrane flap. Two catgut sutures hold them there, and two more are placed in the space in the upper half of the diamond, not penetrating the ureter. The flap valve and attached end of the ureter are now pushed into the cavity of the rectum and the wound closed; the gap in the mucous membrane by reflection of the tongue-shaped flap is sutured by running catgut. Then original wound in the rectal wall is closed with fine silk sutures, the upper two or three being also used for still further securing the ureters where they pass into the submucous space in the upper half of the diamond.

Krynski's [112] plan was nearly the same, except that he made an isosceles triangular flap with the detached base below through all the bowel coats except the inner, and then through this he made an opening, at the base of the flap, of sufficient size to admit the end of the ureter, which was sutured in place and covered by the flap. Maydl's method is to transplant both ureters with an elliptical piece of the trigone of the bladder, *en bloc,* into the rectum or sigmoid. Gersuny converted the

rectal pouch into a receptacle for urine only by making an artificial anus and shutting off the upper part of the rectum entirely. Mauclaire and Tizzoni divided the sigmoid from the rectum and drew it down to the sphincter ani, sewing it to the anterior rectal wall, thus emptying the ureters into a segment of bowel where fecal matter would hardly present itself. Peters operated extraperitoneally. The Vignoni method is nearly the same as Fowler's; Pisani [113] carried the ureter across the calibre of the rectum and inserted it into the posterior wall. Beck allows a free end of the ureter to project into the rectum. Martin [114] uses the Trendelenburg position, and makes a longitudinal incision of the peritoneum over the ureters down to their insertion into the bladder, and dissects out with his finger the lower three inches of them; ties each ureter near the bladder with strong silk and severs them above; brings each forward and approximates them in front of the rectum by including the wall of each with one fine silk suture armed at each end with a fine cambric needle. He approximates them further by two fine silk sutures passing through the outer walls of the ureters only, securing the two tubes parallel. He now makes a longitudinal incision two inches long through the peritoneum and subperitoneal tissue of the bowel, and dissects back this tissue, so that an oval space of muscular coat of the intestine is exposed the length of the primary incision in the bowel and one inch wide at the centre. The flaps are held apart, the bowel freed of fecal matter, and secured above by a clamp. A small incision is now made through the remaining coats of the bowel about large enough to admit the two ureters without pressure, and about one-third the distance from the lower end of the oval denudation. A double-threaded suture is now passed through the opening into the interior of the bowel. This has been previously placed in the ends of the two ureters. The needles are brought out a slight distance apart shortly below the denudation and about one inch from the opening made for the ureters; they draw the ureters through the opening and to the points at which they pass out of bowel. Elevate ureters at a right angle to the bowel, secure

them to the fibrous and muscular coats of the bowel by a number of closely applied sutures, not to penetrate the mucosa of nor to constrict the ureter. Ureters are now laid parallel to the bowel on the denuded portion, the handling sutures made taut, and additional ones passed, securing ureters to the muscular coat of the bowel as it is rolled in by the tension made on their ends. The ureters are now buried in the muscular coat and the peritoneum covered over it. Petersen [115] has made lateral implantation on animals, of which he will make full reference in his paper.

Unquestionably, when both ureters are to be transplanted, and Maydl's operation, or Pozza's modification of it, are applicable, they are the best. But in many cases the ureters must one or both be resected and implanted in the rectum or colon. In such cases we cannot rely upon the buttons of Boari or Chalot, as the danger of constriction or of too large an opening at the point of junction is greater with them. As the danger of infection of the kidney is to be avoided, the methods of Fowler, Krynski, or Martin seem to be best. The plan of leaving a free end of the ureter in the calibre of the bowel, as done by Beck, may prevent infection, but to me it would seem the interference with the blood supply of this portion would cause it to slough. To me it seems the danger of reflux of urine is great, and if this is guarded against great care is necessary to prevent obstruction at this point. The operation of making an artificial anus at the iliac region and shutting off fecal matter, as practised by Gersuny, may be indicated. But to me there appear to be no cases calling for so much work with such slight results. Even the better plan of Tizzoni and Mauclaire would not be applied often. We naturally turn to view the practical results of rectal grafting of the ureter, and we find in most cases there exists an intolerance on the part of the rectum for some time. The movements are frequent, and the pressure of the urine against the wall where the ureter enters is usually too slight to prevent ascending infection along the ureter with reflux of the urine. But this is not always present. In Peters's case there was rectal

tolerance from the first, and many that have suffered early from this trouble have later become practically inured to it. In some cases constipation has been removed by this operation; and in one of von Eiselsberg's cases a preceding chronic diarrhœa was immediately checked. It is probable the carefully made oblique or longitudinal graft will be devoid of the danger of infection; but it is to be feared in all cases. With the progress of surgery daily developing new fields and the newer technique, we must expect this operation to be rapidly popularized.

CASES OF BOWEL IMPLANTATION OF THE URETER.

(1) Simon.[1] In 1851; a loop of thread, passed in an ingenious manner, was made to ulcerate through contiguous portions of ureter and rectum in a case of exstrophy of bladder in a boy thirteen years of age. Communication resulted and continued, though urine escaped by skin, and patient died of suppurative pyelitis at end of one year.

(2) T. Smith.[2] In 1871 grafted each ureter into colon on corresponding side for exstrophy of bladder; operation on left side fourteen months after right; death in twenty-four hours. Necropsy; left kidney hydronephrotic from stenosis (probe passed along ureter would not enter bowel); obstruction at point of graft on right side; kidney showed chronic changes.

(3) Küster.[3] For cancer of prostate involving bladder did cystotomy, liberating bladder from peritoneum; then median perineal incision eight centimetres long; cut and isolated urethra below prostate; returning to hypogastrium, cut ureters and lifted bladder and prostate together; transplanted ureters into rectum; sutures did not hold; death on fifth day of peritonitis and ascending pyelonephritis.

(4) Chaput.[4] September 13, 1892, for fistula communicating with vagina and a point high in ureter, following vaginal hysterectomy; ureter dilated; anastomosis made with posterior surface descending colon; drain in post-peritoneal space. One year later no infection had occurred.

(5) Chaput.[5] Tubercular cystitis and vesical fistula following operation; ureters implanted into rectum three months apart; suppression of urine; death same day.

(6-10) Maydl.[6] Reports five cases done by his plan for ectopia vesicæ, one of which died of prolonged narcosis; four cured.

(11, 12) Duplay.[7] For tubercular and other bladder disease did two cases, both of which died. No method explained.

(13) Kossinski.[8] In 1894 did vaginal hysterectomy and cystectomy for cancer successfully, and implanted ureters into bowel.

(14) Rein.[9] Ectopia vesicæ, Maydl operation, suturing in two layers, momentary results good, but according to Boari[10] abscess formed some time after, and the patient died.

(15) Resegotti.[11] Did a Maydl operation for ectopia vesicæ; success.

(16) Trendelenburg.[12] Tubercular left kidney and bladder; removed them, and successfully grafted right ureter into colon.

(17) Vasilyeff, M. A.[13] For malignant disease of bladder did a successful Maydl operation.

(18) Tuffier.[14] Alveolar epithelioma of bladder in a man; cystectomy, October 20, 1895, with rectal graft of ureters; died May 14, 1897. Details surrounding last of illness and death not given.

(19) Leet.[15] Implanted one ureter into rectum; death from irrelevant cause at a some later time; autopsy showed no dilatation or infection.

(20) Bergenhem, B.[16] Removed bladder and successfully implanted ureters into rectum by Maydl's method.

(21) Schinkler.[17] Unsuccessful Maydl operation, January 27, 1895.

(22) Krynski.[18] Did a successful Maydl operation for ectopia vesicæ.

(23) Chalot.[19] In a case of cancer of uterus removed uterus and implanted both ureters obliquely into rectum, the right an inch below the left; success.

(24) Trombetta.[20] Did a successful Maydl operation for ectopia vesicæ.

(25) Wölfler.[21] Did a successful Maydl operation for ectopia vesicæ.

(26) Casati.[22] Vesical tuberculosis; Boari button used for grafting left ureter into colon; death in thirty-five days.

(27) Boari (*loc. cit.*). Vesicovaginal fistula with complete destruction of urethra; successful graft in rectum with button.

(28) Herczel.[23] May 25, 1897, did successful Maydl operation for ectopia vesicæ in a boy of five years, removing bladder and inserting both ureters into sigmoid, right at upper and left at lower end incision.

(29) Mikulicz.[24] Maydl operation; pyonephrosis; defective continence and death in four months.

(30) Park, Roswell.[25] Maydl operation for ectopia vesicæ; death.

(31) Fritsch.[26] A fatal case of rectal implantation of ureter.

(32) Fowler, G. R.[27] Did his operation successfully in a case of ectopia vesicæ.

(33) Kummel.[8] Removed bladder of a woman in 1892, and was unsuccessful with rectal grafts of ureters.

(34, 35) Frank.[28] Two successful Maydl operations for ectopia vesicæ.

(36, 37) Schnitzler.[29] Two cases of rectal graft of ureters for tubercular and other diseases of the bladder; one died.

(38) Tuffier.[30] Successful modified Maydl operation for exstrophy in boy of fifteen.

(39) Pressat.[31] Successful sigmoid graft of ureter.

(40) Boari.[31] Successful Maydl operation (with additional piece of bladder mucosa) for exstrophy.

(41) Crespi.[31] Successful case done as Boari's, December 8, 1896.

(42) Cappello.[31] Did a successful Pozza operation for exstrophy.

(43) Pozza.[32] Modified Maydl operation in a successful case for exstrophy of bladder by grafting a considerable portion of the trigonum with vesical end of ureters.

(44, 45) Ewald.[33] Two successful cases of grafting ureters into sigmoid for ectopia vesicæ.

(46) Peters.[34] Ectopia vesicæ and rectal prolapse to knees in a child five years of age; extraperitoneal lateral implantation of ureters into rectum; rectal tolerance at once; five weeks after operation urinates every three to five hours during daytime and four to five hours at night.

(47) Cameron.[34] Operated in a case of nineteen years' duration.

(48) Wood.[35] Fowler's operation for ectopia vesicæ in one case; died two months later from kidney infection; high graft.

(49, 50) Herczel.[36] Reports two more successes same as No. 28.

(51-57) Von Eiselsberg.[37] Reports seven Maydl operations, with three deaths.

(58) Wölfler.[38] Reports another successful Maydl operation.

(59) Von Winiwarter.[38] Ectopia vesicæ; successful Maydl operation.

(60) Allen, D. P.[39] Ectopia vesicæ; successful Maydl operation.

(61) Gersuny.[40] Divided rectum from sigmoid flexure, closed upper opening in rectum and implanted into it the ureters and a part of the bladder wall, thereby forming a new bladder, end of flexure carried down through Douglas's pouch and through the sphincter, where it was sutured; success.

(62) Nové-Josserand.[41] For ectopia vesicæ did a successful implantation by method differing from Maydl's in that the removal of the bladder is not done until after the graft is made.

(63) Beck, Carl (personal communication). Inserted ureteral ends with trigonum into rectum for ectopia vesicæ; successful.

(64) Beck, Carl (*Ibid.*). Grafted both ureters into sigmoid, with total exclusion of bladder for tuberculosis of bladder from infection of it after operation for tubercular fistula in ano. Tunnelled bowel wall and left portion of ureters hanging free in bowel to prevent infection. Operation has been done eight months, and no evidence of infection exists.

(65) Albarran.[42] Ureterocolostomy in continuity of ureter done in 1899; death. Autopsy showed the kidney connecting with colon was tubercular, and the other ureter was obstructed with a tubercular mass.

Skin Implantation of the Ureter.—Grafting the ureter to the skin was very strongly recommended by Edmunds and Ballance [116] as the best method of diverting the ureter in case of injuries to it, and especially when the bladder is to be removed. Their conclusion was reached after a series of experiments on cadavers at St. Thomas's Hospital, in 1887. Trekaki [117] has written a long Paris thesis, in which he enthusiastically recommends it, and gives at length the indications for it. He experimented on two dogs.[128] In one, suppuration

occurred on one side and kidney infection resulted, but no other trouble was noticed in either dog; though in the second one but one ureter was diverted to the skin. The history of this plan of diverting the ureter, however, is by no means encouraging. Especially is this true when we consider its many most excellent alternatives. It is sometimes difficult to decide between skin and intestinal graft in cases in which the upper part of the ureter is injured, and but these two methods of saving the function of the corresponding kidney are possible. It is believed the danger of infection from skin implantation is the greater, and that nephrectomy is to be expected. Rydygier attempted to restore the course of the urine by bringing both ends of the severed ureters to the skin, and by means of a skin tube connecting the two ends, sewing over it the skin. Nussbaum [118] implanted both ureters into the skin. Laurenzi,[119] of Rome, in the course of a laparotomy for removal of a cyst of the mesentery, injured a ureter and fixed the end to the abdominal wall. Le Dentu [127] cut off the left ureter englobed in a cancer mass, and transplanted the upper end to the flank. Death from extension of the disease occurred in thirteen days. Pozzi, in 1891, removed a retroperitoneal parovarian cyst and made a lumbar graft with subsequent nephrectomy. Chalot, October 24, 1892, grafted both ureters to the flanks in abdominal hysterectomy for cancer, with a rapidly fatal result. Kufferath,[117] in 1892, injured a ureter in the course of an operation for the removal of an ovarian cyst; grafted it to the skin. Budinger [120] cut off the right ureter in a hysterectomy and sutured the stump to the abdominal wall with the uterine stump; infection; twenty-one days later attempted nephrectomy and found a large renal abscess, which he incised. Twenty-two days later a sound could not be passed far along the ureteral fistula, and no excretion of urine from it occurred. C. P. Noble, in removing an ectopic pregnancy, cut out considerable of the ureter and implanted it to the skin preparatory to nephrectomy, which was done subsequently with success. Harrison,[121] in 1897, in a case of ectopia vesicæ with an infection of one kidney and suffering with scarlatina,

did nephrectomy, and grafted the ureter of the other side to the skin of the loin. Fullerton,[59] in 1898, in removing a large intraligamentary cyst, cut off a ureter and implanted it in the abdominal wound with a long flexible catheter in it. Death from recurrence of the disease occurred four months later. There was no discharge from the catheter at any time.

Thus it will be seen skin grafting of the ureter has been done ten times. In Chalot's case death occurred from shock. In Noble's, the operation was considered a *dernier ressort,* and a successful nephrectomy was done. The result in the cases of Laurenzi,[127] Kufferath, Nussbaum, and Harrison is not given. Budinger's was a clear case of ascending infection, and in his as well as in Fullerton's the kidney function had been terminated before operation, or as a result of it. In Le Dentu's case extension of the disease caused death in thirteen days, and in Fullerton's at the end of four months. In Le Dentu's case one can hardly understand the indication for such a procedure thirteen days before cancer caused death, and in Fullerton's I was unable to find any statement of hers indicating the nature of the disease that recurred. One must suspicion the possibility of infection here. In my judgment, skin grafting of the ureter is not an alternative for bladder or ureteral anastomosis of it; nor of even a bowel implantation except in the very rarest cases. Should the kidney be in a dangerous condition when grafting of its very short ureter stump is necessary, and it be impossible to unite the two ureteral ends, then skin grafting of the stump may be done. If this be the only kidney, then bowel implantation is preferable. In grafting the ureter to the skin, we should always have in mind the probability of kidney infection and the necessity for nephrectomy.

Implantation of the Ureter into the Vagina.—This operation has been done but three times. Pawlik,[122] in a woman fifty-seven years of age, having papillomatous masses widely implanted on the neck and posterior surface of the bladder, removed the bladder and made a new one from the vagina, in 1888. He introduced into the urethra a Simon speculum

and catheters in the ureters; then incised the anterior vaginal wall, using the ureteral catheters as guides; sutured the ureters to the vaginal wall and cut them off near the bladder; kept two sounds in the ureters; twenty-five hours later extirpation of the bladder by the suprapubic median incision of ten centimetres. The bladder, filled with iodoform emulsion, was removed to the urethra. The posterior wall of the urethra was sutured to the posterior vaginal wall, and the anterior vaginal and urethral walls were also sutured together. Retropubic and vaginal fistulæ followed, which he later closed. Three years later she was holding urine well, and evacuating it by means of self-catheterization. Chavasse,[123] December 6, 1897, operated on a child four years of age suffering from ectopia vesicæ. He implanted the ureters separately into the vagina and dissected away the bladder. November 2, 1898, the patient was presented to the Midland Medical Society as well. Kossinsky,[118] of Warsaw, successfully implanted the ureters into the vagina.

Little can be said for this method of dealing with such severe lesions of the urinary organs. While the three cases appear to have been successful, it seems to be grafting a perpetual infirmity upon an individual.

Urethral Grafting of Ureters.—Five cases have been reported in which this operation has been done, in four of which ectopia vesicæ was the condition from which the relief was sought. In the other case death from uræmia resulted, perhaps from the kidney cancer present. It is believed this operation has a limited field, but as a substitute for Maydl's operation for ectopia vesicæ it probably is a failure. Sonnenburg [124] removed the bladder in ectopia vesicæ and grafted the ureters into the urethra in the glans penis. The patient was obliged to wear a collecting apparatus for the dribbling urine. Estor [125] had a case of ectopia vesicæ in which by Sonnenburg's method he did a successful operation. J. Rilus Eastman [126] had a case of exstrophy of the bladder in which the left kidney was pyonephrotic and the right was in a condition of chronic nephritis. He removed the left kidney and did a Sonnenburg

operation with success. Lindnet,[117] of Berlin, in a case of cancer of the bladder, extirpated the entire tumor and implanted one ureter into the urethra. The patient died of uræmia, and the autopsy showed that the implanted ureter had not functionated. The corresponding kidney was the site of a primary cancer. Von Iterson [117] has done successfully a Sonnenburg operation.

BIBLIOGRAPHY.

[1] Simon: Mathes, Deutsche Zeitsch. f. Chir., Leipzig, 1897, Band xlv, 136-153.
[2] Smith: St. Bartholomew Hospital Reports, 1879, Vol. xv, p. 29.
[3] Küster: Verhandl. der deutsche Gesellsch. f. Chir., Berlin, 1891, Band xx, Pt. II, 255-269.
[4] Chaput: Arch. Gén. de Méd., Paris, 1894.
[5] Chaput: Rev. de Chir., 1893.
[6] Maydl: Wien. med. Woch., 1894. Ibid., 1896.
[7] Duplay: Arch. Gén. de Méd., 1894.
[8] Kossinski: (Quoted by Tuffier and Dujarier.)
[9] Rein: Centralb. f. Gynäk., Leipzig, 1894, Band xviii, 383.
[10] Schopf: Allg. Wien. med. Zeitsch., 1886.
[11] Resegotti: Gazz. Med. di Torino, 1895, xlvi, 917.
[12] Trendelenburg: Congress of the German Surgical Society, 1895.
[13] Vasilyeff: Russk. Chir. Arch., St. Petersburg, February, 1895, i, 569.
[14] Tuffier: Rev. de Chir. de Paris, 1898, xviii, 277-289.
[15] Leet: Columbus Medical Journal, 1895, Vol. xv, p. 499.
[16] Bergenhem: Eira, Stockholm, 1895, xix, 265-268.
[17] Schinkler: Duvall et Tesson, Ann. d. Mal. d. Org. Gen.-Urin., 1900, xviii, 269-279.
[18] Krynski: Centralb. f. Chir., 1895, No. 4, p. 73.
[19] Chalot: Independ. Med., Paris, 1896, ii, 297.
[20] Trombetta: Arch. ed Atti d. Soc. Ital. di Chir., Roma, 1897, xi, 343-352.
[21] Wölfler: Wien. klin. Woch., 1896.
[22] Casati: Boari, Ann. d. Org. Gen. Urin., Paris, 1896, xiv, 1-25.
[23] Herczel: Pest. Med. Chir. Presse, Budapest, 1897, xxxiii, 1125-28.
[24] Mikulicz: Tietze, Beiträge z. klin. Chir., 1897, Band xviii, 1-38.
[25] Park, Roswell: Medical News, 1897, Vol. lxx, p. 702.
[26] Fritsch: Die Krankh. d. weibl. Blase, in Veit's Handb. d. Gynäk., 1897.
[27] Fowler: Brooklyn Medical Journal, 1898, Vol. xii, p. 115.
[28] Frank: Wien. klin. Woch., 1898, No. 43.
[29] Schnitzler: Ibid.
[30] Tuffier: Gaz. Hebd. de Méd., Paris, 1898, iii, 661.
[31] Pressat: Boari, Atti Acad. d. Sc. Med. e Nat. in Ferrara, 1898-99, lxxiii, 221-246.
[32] Pozza: Gaz. degli Ospadili e delle clinische M. 28, 1898.

[33] Ewald: Wien. klin. Woch., 1898, No. 43.
[34] Peters: Canada Lancet, 1899-1900, Vol. xxxii, p. 23.
[35] Wood: Philadelphia Medical Journal, 1899, Vol. iii, p. 133.
[36] Herczel: Centralb. f. d. Krankh. d. Harn. u. Sex. Org., Leipzig, 1899, 563-585.
[37] Von Eiselsberg: Bax. zur Operat. Behandl. d. angeborenen Blassenspalte, etc., Inaug. Dissert., Königsberg, Band i, 1899.
[38] Wölfler: Mazel Beiträge für klin. Chir., 1899, Band xxiii, 444-497.
[39] Allen, D. P.: Journal of the American Medical Association, 1899, Vol. xxxiii, p. 259.
[40] Gersuny: ANNALS OF SURGERY, 1899, Vol. xxx, p. 239.
[41] Nové-Josserand: Rev. Mens. de Mal. de l'Enf., Paris, 1899, xvii, 258-262.
[42] Albarran: Duval et Tesson, Ann. d. Mal. d. Org. Gen.-Urin., Paris, 1900, xviii, 269-279.
[43] Tauffer: Deutsch. med. Woch., 1877, No. 37, p. 438.
[44] Westermark: Central. f. Chir., Leipzig, 1892, Band xix, 184-188.
[45] Dunning, L. H.: Journal of the American Medical Association, 1899, Vol. xxxiii, p. 1278.
[46] Krause: Centralb. f. Chir., Leipzig, 1895, Band xxii, 220-226.
[47] Lotheissen: Wien. klin. Woch., 1899, Band xii, 883-888.
[48] Israel, James: Berl. klin. Woch., 1899, Band xxxvi, 201.
[49] Veit: Zeitschr. f. Geb. u. Gynäk., Band xxxi, 462.
[50] Pozzi: Ann. des Mal. d. Org. Gen.-Urin., Paris, 1895, xiii, 428-433.
[51] Schwartz: Rev. de Chir., 1897, xvii, 1045.
[52] Baldwin: Philadelphia Medical Journal, 1898, Vol. ii, p. 1097.
[53] Baldy: American Gynæcological and Obstetrical Journal, 1896, Vol. ix, pp. 462-467.
[54] Penrose: Medical News, April, 1894.
[55] Krug: American Gynæcological and Obstetrical Journal, 1894, Vol. v, 495-497.
[56] Delageniere: Arch. Méd. d'Angiers, 1897, i, 622-630.
[57] Füth: Centralb. f. Gynäk., July 16, 1898.
[58] Polk: American Gynæcological and Obstetrical Journal, 1898, Vol. xii, p. 200.
[59] Fullerton: American Gynæcological and Obstetrical Journal, 1898, Vol. xii, p. 91.
[60] Graupner: Inaug. Dissert., Strasburg, 1897.
[61] Podres: Centralb. f. Chir., 1898, Band xxv.
[62] Hanks: American Gynæcological and Obstetrical Journal, 1898, Vol. xiii, p. 273.
[63] Noble, G. H.: Transactions of the Southern Surgical and Gynæcological Association, 1898, Vol. xi, p. 173.
[64] Wertheim: Monat. f. Geb. u. Gyn., Berlin, 1900, Band xi, 438-452.
[65] Creutz, Ueber einen Fall von Resect. d. Harnblase mit Verlagerung des Ureters; Inaug. Dissert., Giessen, 1898.
[66] Westermark: Hygeia, lvii, and Centralb. f. Gynäk., 1895.
[67] Albarran: Ann. d. Mal. d. Org. Gen.-Urin., xiii.

[68] Verkoogen: Soc. belge d. Chir., 1897-98, v, 198-202.
[69] Küster: Arch. d. klin. Chir., Berlin, 1896, 465-472.
[70] Bardenheuer: Verhandl. d. deutsch. Gesellsch. f. Chir., 1891, Band i, 136-143.
[71] Novaro: Wien. med. Woch., 1894.
[72] Bottini: Centralb. f. Chir., 1893, No. 27, 596.
[73] Martin, A.: Monatssch. f. Geb. u. Gynäk., Berlin, 1899, Band x, 446-457.
[74] Kaysar: Centralb. f. Chir., 1897, Band xxiv, 1221-1223.
[75] Ferguson: American Gynæcological and Obstetrical Journal, 1898, Vol. xii, p. 629.
[76] Calderini: Ann. di Ost. e Gyn., April, 1899.
[77] Sokoloff: Deutsch. Zeitsch. f. Chir., 1899, Band lii, 185-205.
[78] Bazy: Ann. d. Mal. d. Org. Gén.-Urin., Paris, 1894, xii, 481-499.
[79] Trendelenburg: Cestan, Gaz. Hebd. de Méd., Paris, 1896, xliii, 181.
[80] Boldt: American Journal of Obstetrics, 1896, Vol. xxiii, pp. 844-858.
[81] Mackenrodt: Centralb. f. Gynäk., Leipzig, 1899, Band xxiii, 318-323.
[82] Albarran: Wien. klin. Rundschau, 1897.
[83] Colzi: Lo Sperimentale, 1895, xlix, "sezzione biologica," i, 37.
[84] Rouffart: La Presse Méd., 1897.
[85] Bushbeck: Arbeiten aus der Königl. Frauenkl. in Dresden, 1895, Band ii.
[86] Tuffier: Ann. d. Mal. d. Org. Gén.-Urin., 1895, xiii.
[87] Routier: Ibid., 1897.
[88] Amann: Centralb. f. Gynäk., 1897, 893.
[89] Sänger: Münch. med. Woch., 1899, No. 1.
[90] McMonagle: Transactions of the American Gynæcological Society, 1899, Vol. xxi, p. 478.
[91] Witzel: Centralb. f. Gynäk., 1896, No. 11.
[92] Davenport: Fenger, ANNALS OF SURGERY, 1894.
[93] Baumm: Knaggs, Lancet, London, May 27, 1899, p. 1417.
[94] Amann: Centralb. f. Chir., 1898, No. 2.
[95] Kelly: Johns Hopkins Hospital Bulletin, February, 1895, p. 27.
[96] Kelly: American Journal of Gynæcology and Obstetrics, 1898, Vol. xii, p. 734.
[97] Lange: ANNALS OF SURGERY, 1899, Vol. xxx, p. 513.
[98] Benkiser: Zeitsch. f. Geb. u. Gynäk., Band xli, Heft 3.
[99] Bovée: ANNALS OF SURGERY, January, 1897.
[100] Allen, D. P.: Boston Medical and Surgical Journal, 1899.
[101] Durante: Soc. Ital. di Chir., sed., October 29, 1895.
[102] Gusserow: Charité Annal., 12 jahrg., Thomson.
[103] Labisé: Soc. Belge de Chir., Session January 15, 1899.
[104] McMonagle: Transactions of the American Gynæcological Society, 1899, Vol. xxiv, p. 478.
[105] Winslow: ANNALS OF SURGERY, 1898, Vol. xxvii, p. 46.
[106] D'Antona: Boari, Clin. Chir., Milano, 1899, vii, 417-431; 511.
[107] Markoe: ANNALS OF SURGERY, 1899, Vol. xxix, p. 693.
[108] Reynier: Soc. de Chir., Paris, February 8, 1898. See 106.
[109] Schauta: Centralb. f. Gyn., Leipzig, 1899, Band xxiii, 425.

[110] Seiffart: Centralb. f. Gynäk., No. 4.
[111] D'Urso and De Fabii: Suppl. al Policlin., Roma, 1898-99, vii, 249.
[112] Krynski: Centralb. f. Chir., 1896, Band iv, 73.
[113] Pisani: Policlin., Roma, 1896, iii-C, 333-338.
[114] Martin, F. H.: Journal of the American Medical Association, 1899, Vol. xxxii, p. 709.
[115] Petersen, R.: Ibid., February 24, 1900.
[116] Edmunds and Ballance: St. Thomas's Hospital Reports, London, 1887, Vol. xvi, pp. 201-207.
[117] Trekaki, Les Greffes Uretèrales, Thèse de Par., 1899.
[118] See Modlinsky: Centralb. f. d. Krankh. d. Harn-Sex. Org., Leipzig, 1894, Band v, 198-205.
[119] Laurenzi: See Trekaki, 127.
[120] Budinger: Arch. f. klin. Chir., 1894, Band xlviii, 639-682.
[121] Harrison, R.: Lancet, London, 1897, Vol. i, p. 1091.
[122] Pawlik: Wien. klin. Woch., 1891, Band xli, 1814-1815.
[123] Chavasse: Lancet, 1899, Vol. i, p. 161.
[124] Sonnenburg: Verhandl. d. deutsch. Gesellsch. f. Chir., 1882, Band x, p. 158.
[125] Estor, N.: Montpelier Méd., 1899, viii, 39-44.
[126] Eastman: Journal of the American Medical Association, 1899, Vol. xxxiii, p. 263.
[127] Trekaki, P.: Du Meat. Uretèral artificiel, Étude Clin. et Expérimentale, Paris, 1892.
[128] Trekaki: Bull. Soc. Anat. de Paris., 1892, lxvii, 150-157.

THE PATHOLOGY OF FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS.

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It is eighty years since Colles described the fracture that bears his name, and yet there seems no end to the literature on the subject. But in spite of, or because of, this wide discussion, there seems still something to be said on the pathology of the injury, less new, perhaps, in fact than in point of view. Now that the use of the X-ray has stimulated interest in the study of detailed lesions in fractures, now that we are enabled by means of skiagraphs to know, in a given case, something both of the clinical symptoms and of the detailed lesions, we are in a position to review the old evidence intelligently and to combine it with the new. The older notion, of a typical fracture of the base of the radius recurring from case to case with constantly recurring details, has long been untenable. The problem as it is, is to classify, so far as may be, the varying lesions which occur in wrist fractures, and to look this classification over to see if it cannot be made to help out an intelligent treatment and a more accurate prognosis.

There is no real lack of data for this study of lesions.

It is not to be forgotten that there are many recorded autopsies of cases with wrist fractures, a fair number of anatomical examinations made possible by operations, many museum specimens, including not a few recent ones, and a great mass of experimental evidence, which is of some value for confirmation. Valuable as the X-ray is, it is obviously not the best basis for scientific classification of lesions. It will not do to base conclusions as to details on it alone.

In the past, conclusions drawn from the examination of

actual specimens have been somewhat discredited: united fractures are surely somewhat uncertain and admit of a varying interpretation. It has been held that no conclusions are to be drawn from most autopsy specimens,—coming from individuals dying of other injuries received with the wrist fracture, they have been supposed to represent the effects of excessive trauma and to bear no necessary relation to the lesions of the cases commonly seen clinically. In actual fact, however, there are not a few instances where the opportunity for an autopsy was dependent on an intercurrent pneumonia or other infection, and not directly a result of the accident. Yet examination of the records of these particular dissections shows no essential difference from the conditions in other autopsies, and the study of skiagraphs of wrist injuries proves that extensive and complicated bone lesions are by no means unusual or atypical. It may be said in advance that there seems to be no single form of lesion described from any actual specimen, which is susceptible of demonstration in the shadow-picture, that has not been so demonstrated in one or more clinical cases; nor has the X-ray discovered any previously undescribed lesions.

It would seem worth while, then, to study in detail the lesions found in dissected specimens, using the skiagraph and the experimental evidence as a verification only. It needs no argument to show that the X-ray plate, valuable as it is, is in many ways a rather imperfect record.

From this point of view, then, this paper has been prepared, based essentially on such specimens as have been available for examination, on descriptions and plates of other specimens, on autopsy reports, on cadaver experiments by the writer, and on other such experiments found recorded. Many skiagraphs have been examined as a check on the conclusions reached.[1] There proved to be available for the purpose in hand a considerable number of specimens, plates, and descrip-

[1] The cases of which skiagraphs are used for illustration, and most of the other cases cited clinically, were seen at the Boston City Hospital while the writer was Acting Out-patient Surgeon.

tions, representing in all some 180 to 200 preparations.[1] Of these, sixty [2] represent reports of autopsies, specimens obtained by amputation, resection, or other operations, and specimens of ununited, or at least *recent,* fractures in the various museums.

The definition of Colles's fracture is not an altogether rigid one; the fracture as originally described cannot be taken as a hard and fast type, nor can we hold to wrist fractures with a given cause. A fall on the hand is responsible for the vast majority of cases; but even in cases seen clinically a clear history is often unobtainable, and there is good reason to believe that other forms of trauma may give very similar lesions.

For the purpose of study it may be well to include under Colles's fracture all those fractures of the radius which occur within a couple of inches of the wrist-joint.

All these fractures have certain characteristics which are, broadly speaking, constant,—the proximity to the joint, the displacement and rotation of the lower fragment upward, backward, and outward, the forward displacement of the ulna, etc. The variations from this type which occur bear no obvious relation to the variations in the detailed bone lesions, however, and a broad grouping is hardly possible.

It will, perhaps, best serve to take up one by one the single lesions or items, so to speak, which go to make up the fracture as a whole, then later to reconstruct from these the more usual combinations occurring. First as to

Height above the Wrist-Joint.—Colles himself described a fracture an inch and a half above the joint. This is obviously too high. The exact height is not altogether easy to fix on, for few specimens show a fracture either accurately transverse or in a single plane. In thirty-nine museum specimens, however, the average measurement was .68 inch above the joint. Twenty-one X-rays measured by the writer from

[1] The exact number cannot be given because of some duplicating of descriptions. Smith, Cameron, Callender, Bennett, Gordon, Lucas, Hutchinson, and D'Arcy Power have covered something the same ground in the English museums, and, owing to the changing of catalogue numbers, clear distinction as to actual specimens is not always possible.

[2] Not including the epiphyseal separations.

plates taken without selection gave an average of five-eighths of an inch. A large proportion of these twenty-one came very near this average; that is to say, the run of the cases show a height of from one-half to one inch, those higher or lower being far less frequent.[1]

Direction of the Fracture-plane.—It was formerly held that an oblique fracture running up and back was the typical form, but Voillemier drew attention to the frequency of transverse fractures among those occurring within an inch of the joint, while R. W. Smith drew attention to the possible error in estimating obliquity from united specimens.[2] He says, "I



FIG. 1.—United fracture; displaced backward; depression at back filled up with new bone. Warren Museum, No. 5194.

have examined upward of twenty specimens of the injury, and have not found one in which the bone had been broken

[1] The height given by various authors is from one-quarter inch to one and a half, more often one inch, or under. Albert gives a minimum of five milligrammes, Smith of one-quarter inch. Hamilton gives as the maximum one and a half inches, reaching the height set by Colles. Smith in twenty-three cases found none over one inch from the joint.

[2] This error arises from the filling up with new bone of the hollow left posteriorly and, it may be, externally above the lower fragment. This new bone merges in with the lower fragment, and, as it is above the fracture line posteriorly, must necessarily give the appearance of an increased obliquity. (See Figs. 1 and 2.)

with any considerable degree of obliquity." Gordon, on the other hand, found only eight out of twenty-seven specimens examined to be really transverse.

The question is involved, not only on account of the difficulty of interpreting united specimens, but because there is no standard as to what shall be called oblique; for instance, the twelve specimens in the New York Hospital Museum have been reported on by three different observers: Hamilton classes eight as oblique up and backward; Satterthwaite says



FIG. 2.—United fracture; displacement upward and outward; shows the "impaction line." Warren Museum, No. 1040.

nine are transverse; Pilcher classes eleven of the twelve as transverse. Of the reported autopsies and ununited specimens where this point is settled, thirteen are transverse or nearly so, seven definitely oblique up and backward.

As to X-rays, the only view which gives definite data on this point—the lateral view—is unfortunately usually neglected. The impression the writer has gained, however, from this view in both published and unpublished plates, is that any considerable degree of obliquity is exceptional.

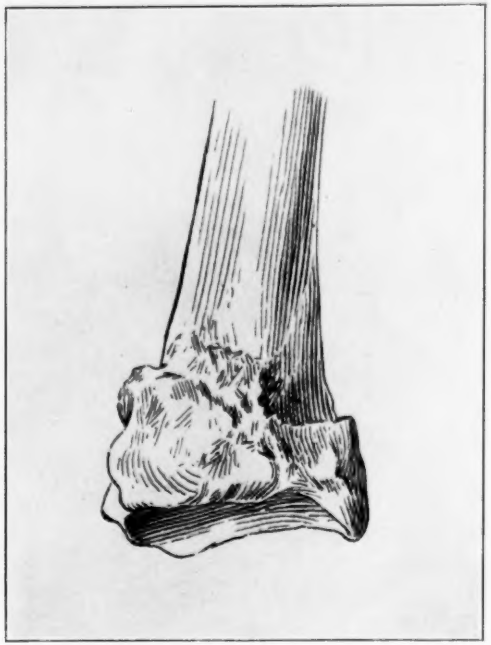


FIG. 3.—Old fracture united with but little displacement; much excess of bone formation at seat of fracture.



FIG. 4.—Fresh case of fracture; fracture transverse, with some displacement upward; partial fracture of ulnar styloid at its base.

Obliquity of the fracture line from side to side is usually in the form of an upward and outward trend. This is not infrequent. The trend upward may increase considerably near the outer edge of the bone, or a transverse fracture may trend upward at this point. As a rule, the obliquity is but slight. Smith says "always trifling" but well marked oblique fractures do occur.

Obliquity in the reverse direction is much rarer; here, too, the slant is usually trifling.

Obliquity from side to side in either direction is not necessarily associated with obliquity in an anteroposterior direction.

Not infrequently one finds a well-marked concavity of the fracture surface of the lower fragment as a whole, a point to which Lecomte long since called attention. Often there is a line of fracture running towards the joint from the convergence of the two slopes, so that the posterior view gives a Y-shaped pattern of fracture lines.

No point in relation to the fracture has been more discussed than that of impaction. Many surgeons have held impaction an essential feature of the fracture, but there has never been any good ground for this view.

Smith long since showed that the "impaction line" seen in section in so many museum specimens and relied on by Voillemier, Cameron, and others (see Figs. 1 and 2), is no proof of interpenetration of fragments, but may represent inclusion of the broken end, especially of the posterior edge of the upper fragment, in the permanent callus. Judgments as to impaction based on examination of united fractures are therefore practically worthless.

There are, however, autopsies and recent specimens enough to throw light on the question.

In the following cases examination showed definite impaction[1] of varying degree:

[1] The usual form of impaction, where it occurs, seems, according to Bennett's studies, to be the reciprocal, in which the upper fragment penetrates the lower posteriorly; anteriorly the lower is driven into the upper, or there may be a hinging with impaction of the upper into the lower at the back, at the front no penetration at all.

Callender, autopsy; Callender, Middlesex Hospital Museum, no number; Callender, Middlesex Hospital Museum, I, 23a; Callender, St. Bartholomew Hospital Museum, C. 136; McGraw and Walker, autopsy; Hamilton, autopsy;

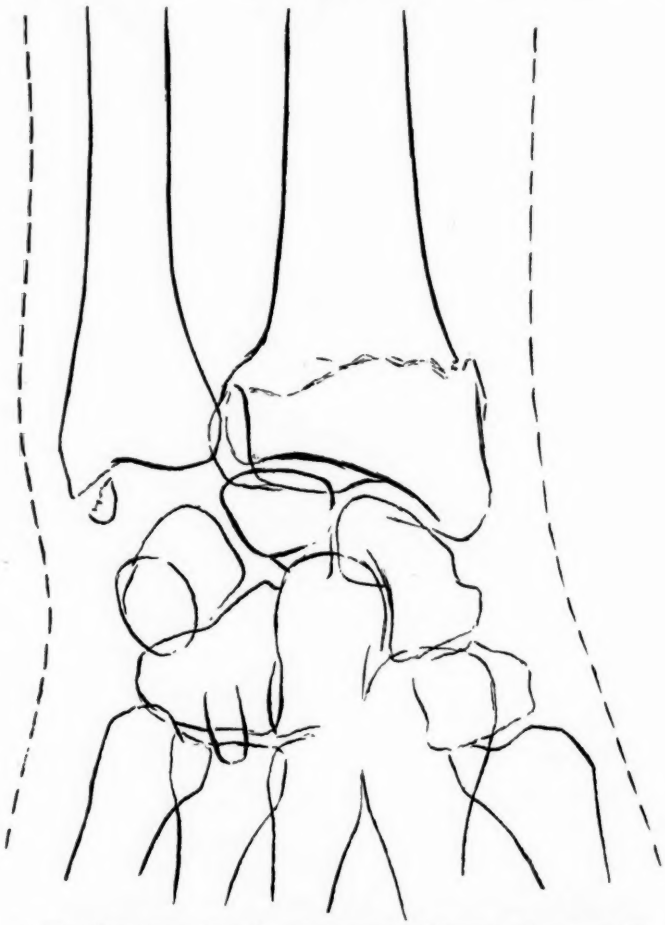


FIG. 5 (Tracing from X-ray).—Transverse fracture of the radius, with little displacement; fracture of ulnar styloid.

London Hospital Museum, recent specimen; Cameron, Glasgow Royal Infirmary Museum, II, 182; D'Arcy Power, St. Bartholomew Hospital Museum, III, 925a; D'Arcy Power, St. Bartholomew Hospital Museum, III, 925b.

On the other hand, there are plenty of autopsies to show the possibility of fractures, simple or comminuted, without any impaction whatever. All the following are authentic cases by competent observers:

Couper and Hutchinson, autopsy; Cameron (autopsy), Glasgow Royal Infirmary, II, 172; Callender, St. Bartholomew Hospital Museum, recent specimen; Moore (autopsy, case Tumey, both wrists unimpacted); Hamilton, autopsy; Smith, fresh specimen, his Case I; Jones, autopsy; Maisonneuve (described by Malgaigne, plate given by Stimson, apparently same case as cited by Schmit from the *Gazette des Hôpitaux*); Warren Museum, Specimen 8117. (Fig. 7.) Hutchinson says that he has seen dissections of seven or eight recent cases, in all of which there was more or less lacking, but in none any real impaction.

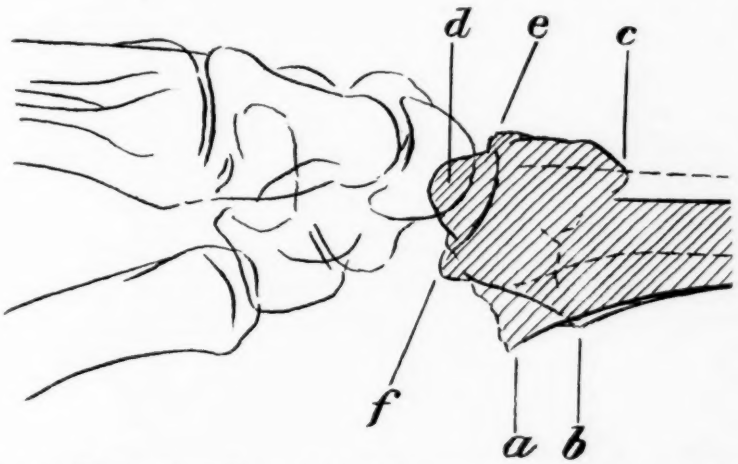


FIG. 6 (Tracing from X-ray plate).—Transverse fracture of the radius; some backward displacement; much rotation backward. The ulna is shown in dotted line; *a, b,* lower end of radial shaft; *c,* back edge of lower fragment; *d,* styloid process of radius; *e, f,* articular surface of radius rotated backward.

The fact noted by Pilcher and others explains certain cases that clinically appear impacted; this is, that in many cases the posterior periosteum is more or less stripped up, but

remains untorn and forms a strap that helps lock the fragments in place.

Muscular tension undoubtedly plays a part as well, and the autopsy reported by D'Arcy Power, where the slight displacement of the fragments could not be reduced until after division of the tendons of the carpal flexors, the extensors of the thumb, and the supinator longus, shows how effectual the

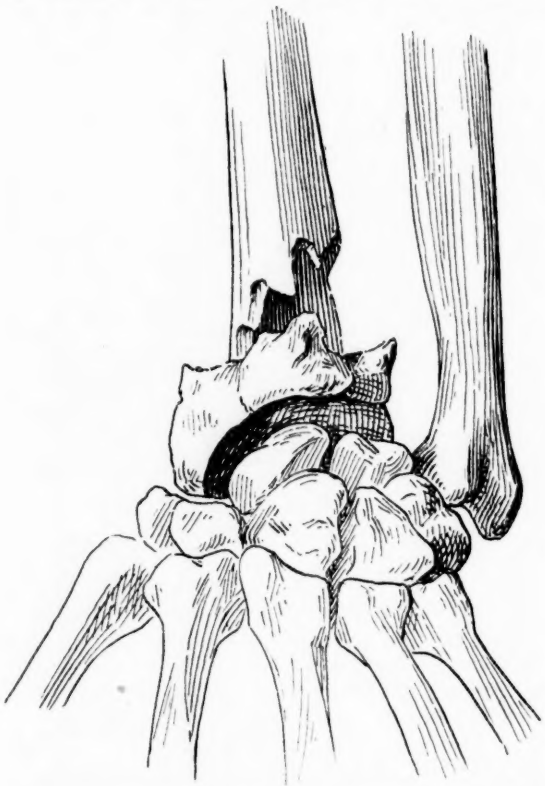


FIG. 7.—"Amputated three inches above condyles for compound Colles's fracture, with rupture of radial artery and subsequent spreading gangrene." (Specimen of Dr. J. C. Warren.) A projecting spur anteriorly caused arterial injury, the fracture transverse, with loss of substance and with considerable backward displacement; lower fragment comminuted at back and ulnar side. Warren Museum, No. 8117.

resistance of even dead muscles may be. So, too, the autopsy of the Couper-Hutchinson case, where reduction was

possible only after most of the wrist tendons had been divided. Here the deformity is said not only to have been maintained, but also produced by the post-mortem rigidity, not appearing until after death.

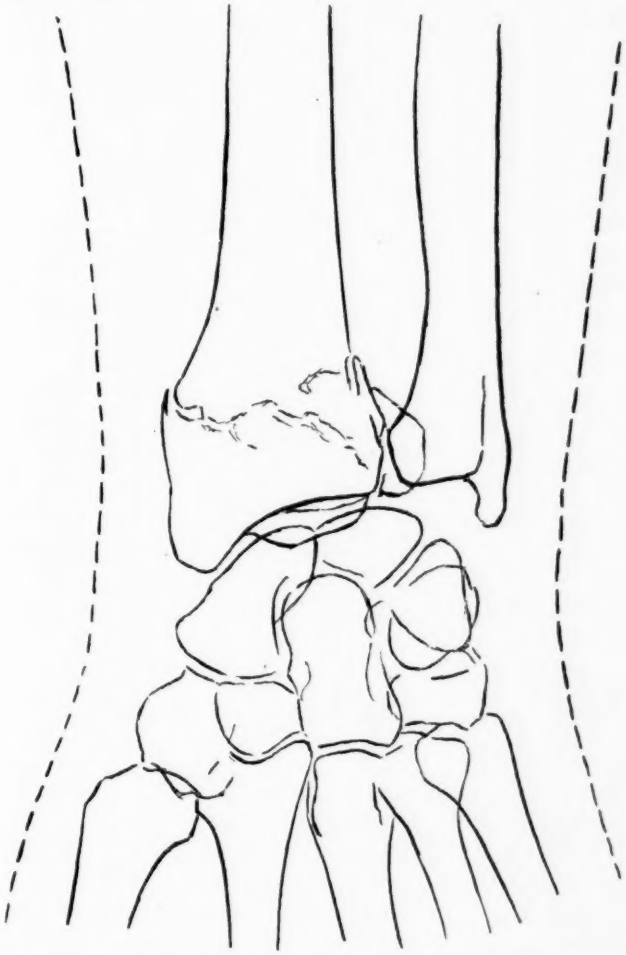


FIG. 8 (Tracing from X-ray).—Comminuted transverse fracture of the radius; slight rotation up and outward.

The firmness of retention after reduction is a measure of the action of these forces, and it is undoubtedly for these reasons that so many cases seem clinically to be impacted. It

is to be borne in mind that the familiar change of relation in the height of the two styloid processes is no sign of impaction, even in the absence of marked lateral displacement. The rise of the radial styloid may show rotation up and outward as well as shortening. The actual shortening when present is under one-half inch, usually much less, and may be due not to impaction but to simple crushing and actual destruction of bony tissue, particularly apt to occur at the back.



FIG. 9.—Transverse fracture; lower fragment comminuted at ulnar border; piece split off from upper fragment at ulnar side of the dorsal surface. Result of direct violence. Warren Museum, No. 1038.

Impaction does not seem to be associated especially with any especial form of the fracture, nor does it seem to stand in any necessary relation to comminution. A comminuted fracture may still be impacted and a simple fracture may show no trace of impaction. It goes without saying, of course, that totally irregular smashing of the radius precludes any impaction.

It is to be remembered that shortening of the radius does not necessarily mean impaction, and the usual clinical measurement of height of radial styloid and ulnar head tells one nothing as to the exact form of fracture. Shortening may re-

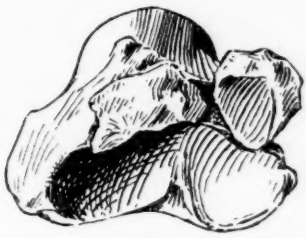


FIG. 10.—No transverse fracture, but separation of the fragments from the posterior edge of the joint surface. Result of direct violence. Scaphoid also fractured. Warren Museum, 3776.

sult from displacement of comminuted fragments, from displacement of an entire lower fragment upward, especially in oblique fractures, or from rotation backward or outward.



FIG. 11.—Epiphyseal separation; left radius showing external and anterior surfaces. Warren Museum, No. 6212.

Such rotation is possible not only by impaction but by crushing of bony tissues as well, and it seems to be common enough to have such crushing that a gap in the bone is left after reduction.

X-ray evidence has been cited to show impaction, but it can be said that most plates so cited really show nothing in the matter, and that the X-ray can hardly give us information on this point.

How frequently impaction occurs we cannot yet say; it certainly is not constant enough to be regarded as typical. It is definitely established that it may or may not be present; it is certainly less frequent than clinical examination would lead one to suppose.

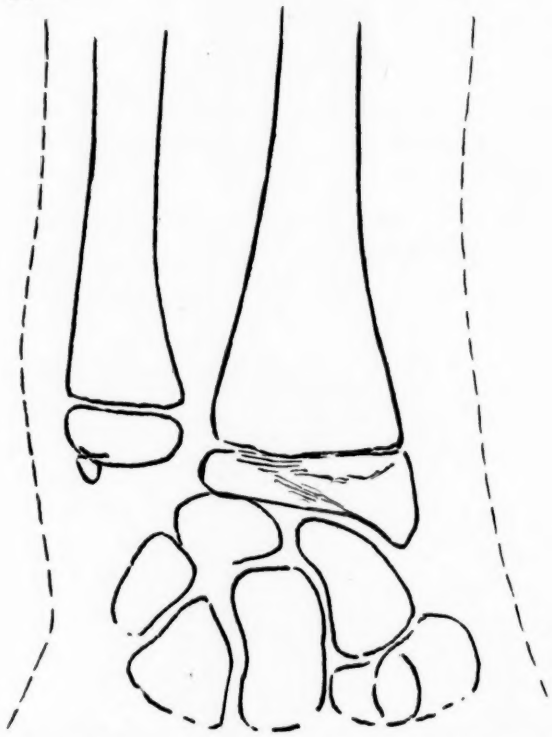


FIG. 12 (Tracing from X-ray).—Separation of the epiphysis of the radius, not now displaced; comminution of the epiphysis; fracture of the ulnar styloid at its base without displacement.

Displacement.—There may be no displacement at all, even if the fracture is comminuted, as in an autopsy by Callender. There may be displacement *in toto* and a rotatory displacement as well.

The usual type shows a displacement *in toto* of the lower fragment backward and upward with a rotation backward, so that the articular surface looks not down and forward, but down and back. (See Fig. 6.) Backward displacement without any notable rotation may occur. (Smith, Case I.)

Rotation back and up does occur with little or no displacement of the fragment *in toto*. Moore (Tumey), Cameron (II, 182), and Callender (St. Bartholomew Hospital Museum, III, 78); but it is possible only by impaction or a considerable actual destruction of bone tissue (such destruction of tissue is

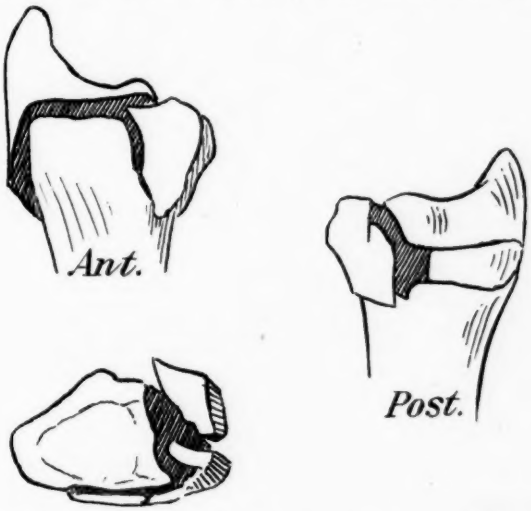


FIG. 13.—Fracture oblique up and backward; irregular comminution (after Rutherford).

shown in plate of McGraw and Walker's case; it may, of course, be far more extensive).

Such rotation may of itself determine a considerable shortening apart from any dislocation of fragments.

Displacement of the fragment outward in some degree is a usual feature [1] and may occur with little backward displace-

[1] This displacement, obvious and frequent in museum specimens, is, curiously enough, disputed by Kahleyss; though his plates show two good instances of it. One of these he admits as an exception (Taf., vi, vii, 4a); the other (Taf., vi, vii, 7) he ignores.

ment, as shown in the plate given by Smith of his Case XIII, also Callender (Museum University College Hospital, C, 4265), and rotation upward and outward is to be noted in most specimens. (*E.g.*, Warren Museum, 1040.) (Fig. 2.)

The rotation outward has been supposed to give an encroachment on the interosseous space,[1] but Gordon found this encroachment but slight where it occurred at all, and the actual fact would seem to be that there is more often a sepa-

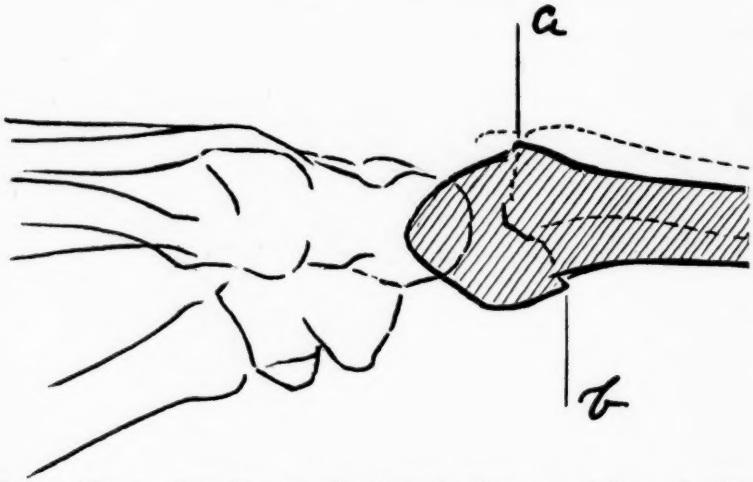


FIG. 14 (Tracing from X-ray).—Fracture of radius up and forward, with slight anterior displacement; backward displacement of the ulna (shown in dotted line), *a*, lower end of upper fragment, overlapping; *b*, upper end of lower fragment, overlapping.

ration of radius and ulna—a diastasis—of the radio-ulnar joint, which would leave this space free in any case. This diastasis is obvious in certain X-rays published by Don and by Beck, and in various others seen by the writer. Fig. 5 shows this in slight degree.

Displacement forward with rotation upward and forward is seen in the so-called reversed Colles: it is very rare. (Fig. 14.)

[1] Plates 25 and 26, in Roberts's monograph, of a specimen in the Museum of the Royal College of Surgeons in Ireland, show this encroachment in a marked degree.



FIG. 15.—Fresh fracture of radius, oblique up and outward; much outward, some upward displacement; moderate rotation of lower fragment; fragment freely movable under ether.

Displacement inward is likewise a rarity, and is slight in extent when it occurs. Smith speaks of such a case (No. VII), also Callender (recent specimen Middlesex Hospital Museum, no number). Picard's Plate II also shows this displacement.

Beside these displacements, a rotation of the lower radial fragment on its long axis is alleged,—a rotation carrying the radial styloid backward. Cases and specimens by Callender, Middlesex Hospital Museum, I, 22c; Callender, St. George Hospital Museum, I, 93; Westbrook, autopsy; Smith (Case XI, Museum Royal College Surgery, Ea, 693; Smith, Case XIII, Museum Peter Street School of Medicine).

This rotation is slight when it occurs. The contrary rotation may occur (specimen, Warren Museum, 6296).

The various displacements and rotations occur in much the same way in comminuted as in simple fracture. Sometimes the pieces of the comminuted lower fragment are widely separated, but more commonly they are more or less closely held together by ligaments and periosteum, and are displaced together practically en masse. (Figs. 7 and 8.)

Lines of Fracture.—The most striking feature found in studying the detailed data of wrist fractures is the variety of lesions. These various possible features of the fracture will first be considered separately.

I. *Simple Transverse Fracture.*—This is a fracture across the full width of the bone, approximately horizontal, with an occasional tendency to trend up and back and up and outward. This is the form to which Voillemier first called attention, and has been accepted by Smith and others as typical. (See Figs. 3, 4, 5, and 6.)

Such fractures may occur at any point from within one-quarter inch above the joint up to an inch and a half or more. In a large proportion of the cases, however, the fracture lies about one-half to three-quarters of an inch up.

Autopsy reports of fresh cases or recent specimens of this class are recorded by Smith (Case I), autopsy; Callender, Museum London Hospital, recent specimen, and in a second

case (autopsy); Moore (autopsy, Tumey); Schmit (recent specimen described in *Gazette des Hôpitaux*); Maisonneuve (recent specimen described by Malgaigne).

There may (as in both Callender's cases noted above) be impaction with this transverse form, or it may be absent as in Smith's case (Case I).

There may be no displacement whatever, or extreme backward displacement and backward rotation as in Moore's case (Moore, case, Tumey), where the broken surface of the lower fragment rested on the periosteum of the upper.

Backward displacement in some degree is rarely absent. The same may be said of the backward rotation; but Smith gives a plate of a specimen with displacement directly backward without any rotation at all. There is usually some displacement and rotation of the lower fragment outward; considerable displacement outward may occur without rotation, as shown in the plate given by Stimson of the Maisonneuve specimen and in a specimen figured by R. W. Smith (his No. XIII, Museum Peter Street School of Medicine).

II. *Comminuted Transverse Fracture.*—The fracture may be in all respects similar to the form just described, save for the complication of fracture lines through the lower fragment into the joint. There is not necessarily any separation of the bits of the lower fragment. (Figs. 7, 8, and 17.)

Such cases are frequent and not necessarily the result of great violence. Hutchinson says that of seven or eight dissections of fresh cases that he has seen, all were comminuted. Bennett found twenty-three comminuted in fifty-four specimens examined, D'Arcy Power twenty-six out of forty-eight. Of five ununited specimens in the Warren Museum there is comminution in all.[1] Probably these figures show a larger proportion than in the run of clinical cases, and a comminution often of severer type, as they represent in a large proportion of cases the results of severe trauma, and inevitably include more or less cases due to direct violence.

Among autopsies and recent specimens of this class are the

[1] This does not include a simple separation of the epiphysis.

following: Cameron, Museum Glasgow Royal Infirmary, II, 182; McGraw and Walker, autopsy; Callender, Middlesex Hospital Museum, I, 23a; St. Bartholomew Hospital Museum, III, 125; St. Bartholomew Hospital Museum, C, 136; Specimens in Warren Museum, Nos. 8117 and 1038; Wight, autopsy; Stimson, autopsy; Moore, autopsy (case Huntington); D'Arcy Power, New Museum Cambridge, no number; St. Bartholomew Hospital Museum, III, 925a; St. Bartholomew Hospital Museum, III, 925b; St. George Hospital Museum, 3423b.

The lines of the penetration into the joint cannot be called constant, but certain lines to which Bennett called attention recur frequently. These he describes as follows: "A fissure starting from the same point in the ulnar facet, runs into the carpal articular cartilage, along its posterior edge, breaking out into the dorsal surface of the bone and then, in the least extensive injuries, at the outer side of the common extensor groove, or in others running along as far as the groove for the radial extensors, and in a few breaking out at each of these positions." (See Figs. 7, 8, 13, and 17.)

This line he found alone in ten of twenty-three comminuted specimens (in a series of fifty-four fractures, mainly museum specimens, but including his two autopsy cases); in six others joined to a branch from this fissure towards the anterior portion of the scaphoid facette. Of all his twenty-three comminuted cases only one showed other than these lines.

The specimen of McGraw and Walker (Fig. 13) shows these lines in the fresh specimen. Similar cases in this respect are three described by D'Arcy Power, so far as can be judged from his descriptions, the two autopsy specimens, St. Bartholomew Hospital Museum, 925a and 925b, and the specimens St. George Hospital Museum, 3423b; so, also, the specimen in Warren Museum, 8117. (Fig. 7.)

In some cases, however, the line of penetration into the joint is anterior-posterior, the lower fragment is split, usually through the scaphoid facette, into two portions. Such cases are reported by Westbrook, Wight, and specimen in St. Bartholo-

mew Hospital Museum, 931 and 932, cited by Poland. (See Fig. 18.)

Not infrequently there is an inconsiderable chipping off of an edge of the articular surface, usually the posterior. So No. 955 of the Hunterian Museum described by Power.

In other cases there is no typical arrangement of lines at all; there is either a comparatively simple arrangement deviating from those just described, as in Stimson's case where two crossed lines divided the articular surface in four pieces, or as in Hunt's (see Fig. 20); or there may be simply shapeless comminution of the whole lower portion of the bone as in the specimens numbered 1002, 1042, and 3693, in the Warren Museum, and in a number of the described autopsies and specimens.

In the majority of cases there is relatively little separation of the portions of the lower fragment; they may be held together by periosteum and not to be separated at all, the fracture being but a thin fissure, not necessarily obvious from the joint side. Such a condition as this is relatively frequent in experimental fractures, and is probably frequent enough clinically in cases where the X-ray may not show it. D'Arcy Power describes such a specimen (St. Mary's Asylum College, 136) and a second (St. Bartholomew Hospital Museum, 926), where the comminution, as he says, has so healed as to leave but a line on the joint side. Cameron's specimen (Glasgow Royal Infirmary Museum, II, 182) also showed a lower fragment, split in three, firmly held by periosteum.

III. *Separation of the Radial Epiphysis.*—This may be looked for up to the age of eighteen or nineteen years, though Voillemier instances two cases where the consolidation of this epiphysis with the shaft was delayed to the age of twenty-four and twenty-five years respectively. The most usual age for this lesion is between twelve and eighteen years. The lesion is much the same in most cases; but the distinction can be broadly drawn that pure epiphyseal separations occur especially in younger children, while the lesion in older patients is more likely to be anteriorly a separation in the

epiphyseal line, while posteriorly the line of fracture trends upward; this may result simply in the removal of a sliver of bone (see Fig. 11), or the wedge above the epiphysis carried away with it may be of considerable size.

This lesion has been most carefully studied by Vogt, Bruns, Di Paoli, Bennett, and lately in the wonderfully complete monograph on epiphyses by Poland. Clinically, the injury is far less common than Colles's fracture, but opportunities for study have been many, for a very large proportion of cases are compound, and many deaths from sepsis and many amputations swell the list of specimens. Moreover the injury seems to be, in larger degree than Colles's fracture, a product of severe trauma, and is relatively often found in children dead from severe falls. In all there are sixty specimens of which accurate examinations are at hand. These include, according to Poland, fourteen compound cases, and this list seems not to include the case of Lehmann (cited by Roberts). These cases seem all to have been compound anteriorly, the radius protruding in some, sometimes complicated with a wound made by the ulna, in others the ulna alone has protruded.

The displacement has usually been backward, much as in Colles's fracture, and may be extreme, as in the specimen from the Royal College of Surgeons Museum, 956c, of which Poland gives a plate. In these cases especially, and in a large proportion of all cases, the periosteum, torn in front, is stripped up posteriorly, as often in true Colles's fracture (*e.g.*, specimen 758b in St. Bartholomew Hospital Museum, with a stripping up of one and one-quarter inches); this stripping up seems in fact more usual in the epiphyseal cases. There is little tendency to lateral displacement in these cases, much less than in true fracture.

Forward displacement seems not very unusual. Poland cites five instances, and the cases of Lehmann and of Wight, quoted by Roberts, seem authentic.

The damage to the radius varies, as has been said, in the amount of diaphysis carried away with the lower fragment,

and in the presence or absence of comminution. Specimens described by Callender (two), by Bennett, and by Dolbear showed this, and the appended X-ray (Fig. 12) shows this splitting through the thin portion of the epiphysis. As the thickness at the centre is only some five-sixteenths inch in the full-grown bone, this occurrence is not surprising.

The damage to the ulna with the radial separation is not constant, but frequent enough. The ulna may be fractured (Hilton, Lehmann, Bruns), or its epiphysis may be separated (Di Paoli, plate by Poland); Bruns, three cases; or there may be a separation of the ulnar styloid (autopsy by Shattock, case of Wight, and St. Bartholomew Hospital Museum, 758B; Royal College of Surgeons Museum, 956C; Guy's Hospital Museum, No. 587; St. George's Hospital Museum, 3424, 114b).

This lesion is also shown in the X-ray plate, Fig. 12. The luxation of the ulna occurs much as in Colles's (Moore, Di Paoli).

Johnston gives a case of tearing of the internal lateral ligament.

The triangular fibrocartilage may give way, as in the fracture (specimen 956B in Royal College of Surgeons Museum, and in an autopsy by Moore).

Most interesting of these epiphyseal separations are those without displacement and the partial separations. Of the latter class D'Arcy Power described a dissected specimen, and since the study of these lesions with the X-ray has attracted attention to them, many clinical cases are to be found. They give the signs of local damage and sometimes mobility; the X-ray shows almost nothing.

As has been said, the complete separations are usually the result of falls, and usually (according to Di Paoli in 19 of 35, according to Poland an even larger proportion, 38 of 40) from falls on the palm. Falls on the palm in young patients with unconsolidated epiphyses, where the trauma is less, seem curiously enough to lead either to fracture above the epiphyseal line (see Fig. 16) or to a simple springing and

wrenching of the epiphyseal line, evidenced by extreme well-localized tenderness, and by an appearance in the skiagraph of a slight widening of the line (not constantly present and likely to be obvious at one side only). There is rarely a fracture of the styloid of the ulna. Apart from the specimen cited, there seem to be no anatomical data as to these cases, which are frequent and need farther study.

The shortening resulting from the epiphyseal separation, though well attested by eighteen recorded cases, seems not to be usual, occurring but twice in thirty-two cases seen at the time of the injury and followed up. The shortening, when present, may be extreme, as in a case of Hutchinson's, where it amounted to two and one-quarter inches.

Whether it bears any definite relation to extent of displacement, to extent of comminution, or to improper reposition, is yet to be settled.

IV. *Fracture Oblique Upward and Backward.*—This, once supposed the typical form of Colles's fracture, is probably, unless one regards the very slight grades of obliquity, less common than the approximately transverse forms.

The difficulty of judging united specimens in this regard has been dwelt on, and even with the X-ray only the often neglected lateral view can decide this point.

Fresh specimens of this type from autopsies are described by (1) Couper-Hutchinson; (2) Löbker; (3) Cameron (Glasgow Royal Infirmary, II, 172); (4) Rutherford (autopsy); (5) Moore (Tumey, autopsy); (6) Bulteau (specimen I), autopsy; (7) Bulteau (specimen II), autopsy; (8) McGraw and Walker, autopsy.

The specimen described by Packard (Museum New York Hospital, 130) and the specimens in the Warren Museum, 5194 and 1040 (and a new unnumbered specimen), though not fresh, are convincing as to obliquity.

The fracture, at any angle of obliquity, may be combined with any slope upward and outward. Like the transverse fractures, many of these are comminuted (as Nos. 3, 4, 6, 7, and 8 of the above list).

The patterns of comminution—the lines of joint penetration—seem in no way different, so far as recorded, from those described for the transverse fracture. Either the lines described by Bennett occur (he does not, in his description, separate the transverse from the oblique forms in this regard), or the anteroposterior split (shown in the case of Rutherford, for example) may occur.

As a subclass of these fractures oblique downward and forward are to be reckoned the so-called Barton's fractures, oblique downward and forward, but running only from the posterior surface down and into the wrist-joint, not reaching the anterior surface.

There seems no doubt that the cases on which Barton based his description were of simple Colles's fracture; but the fracture he supposed to exist in these cases has actually occurred, though it is very rare. The only specimens of which there is any accurate record seem to be those of Neill (plate in Agnew's Surgery, Vol. i, 905); Lenoir (quoted by Voillemier); Flower (Middlesex Hospital Museum, autopsy); Warren Museum, No. 3776. (Fig. 10.) As to the clinical occurrence of this lesion, the writer has seen no case, nor any skiagraph showing this lesion.

Apparently, Hecht's case of compound dislocation with fracture of the posterior part of the radial styloid also belongs in this class.

V. *Oblique and Upward and Forward.*—There are not a sufficient number of good specimens or records of this class of fracture to form a basis for conclusions as to its frequency. It has been assumed that forward displacement of the lower fragment implies such obliquity, but this seems to be by no means certain. Roberts has written an admirable monograph on the fracture with forward displacement, and has succeeded in collecting twenty-four clinical observations and thirty-one specimens classed as exhibiting this displacement. Unfortunately, the data in regard to some of these instances are rather defective, yet this form of the fracture is evidently less rare

than has been supposed. Fig. 14 shows the writer's only case of this sort.

The only anatomical examination of an anterior displacement that the writer finds recorded is one by Lucas, not included in Roberts's series. This was a case of a woman of fifty-six who trod on her dress and fell forward onto the palms of both hands. On the right there was a simple Colles's fracture. The fracture on the left was compound, became septic, and had to be amputated. On dissection, the fracture line proved to be notably oblique upward and forward, but it is plainly to be seen from the excellent plate given that the forward displacement was but slight, the projection of the lower fragment anteriorly was largely due to the sharp rotation backward of the whole lower fragment. The deformity in life was that of the ordinary Colles's fracture.

Curiously enough, the two other specimens noted as showing obliquity of the fracture line in this reversed direction (Smith, specimen in Park Street School of Medicine, his Case II, and Flower, specimen in the Museum of the Royal College of Surgeons) do not show forward but backward displacement.

As to obliquity of the fracture upward and forward, it would seem, then, as if there were no connection between obliquity of the fracture upward and forward and the anterior displacement; nor can we say that the connection of this displacement with falls on the back of the hand is established. Cases of such falls are well attested in which fracture with ordinary backward displacement resulted (Cameron, Hamilton, Hennequin, Kahleyss), while two of Roberts's list of cases, with anterior displacement, seem to have been produced by falls on the palm.

For the present, then, one can hardly say more than that anterior displacement may occur, probably not so very rarely, that it may occur with fractures oblique in any direction, or transverse, including separations of the epiphysis (Roberts's Specimen I from the Mutter Museum, Denonvilliers, Péan, and Roux). It is probably usually, though certainly not al-

ways, a result of a fall on the dorsum of the hand. The dislocation of the ulna is back instead of forward. The ulnar styloid may be broken (Callender).

The type of fracture assumed by Barton to exist, the reverse of that usually known as Barton's fracture, a fracture, that is, involving only the anterior edge of the articular surface of the radius, may be produced experimentally, but hardly occurs during life. There seems to have been but one such specimen found, that of Letenneur cited by Stimson.

VI. *Fracture Oblique Upward and Outward.*—These are not infrequent, and occur as (*a*) fracture oblique upward and outward through the whole width of the bone; (*b*) fracture transverse towards the inner side trending up and out externally; (*c*) oblique fracture penetrating the joint.

Group (*a*) may be illustrated by the skiagraphs Figs. 15 and 16, and by the (united) museum specimen No. 2627 in the Museum of the School of Physic, Trinity College, Dublin, of which Roberts gives a plate. Group (*b*) is represented by Westbrook's specimen (see Fig. 18). Group (*c*) is illustrated by Hunt's case (see Fig. 20). In this group would also fall the specimen in the Mütter Museum numbered 1277, 65, described by Roberts, and Gordon's two specimens from the Museum of Queen's College in Belfast, his "third form" of fracture.

In all three groups there is likely to be much outward displacement and rotation, but not necessarily obliquity of fracture or displacement in either direction anteroposteriorly. In the last three cases cited there was displacement forward as well as outward. Other fractures of like direction, but detaching only the radial styloid, will be considered with the next group.

(TO BE CONTINUED.)

TETANUS.

A STUDY OF THE NATURE, EXCITANT, LESIONS, SYMPTOMATOLOGY, AND TREATMENT OF THE DISEASE, WITH A CRITICAL SUMMARY OF THE RESULTS OF SERUM THERAPY.

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The literature upon tetanus for the past ten years is scattered through the journals of all countries and nationalities; and, with rare exceptions only, a majority of these articles belong to the class of casuistic material. This is particularly true since the discoveries of Tizzoni and Cattani and Behring, which in one measure, at least, mark an epoch-making period in the therapy of tetanus. That this subject cannot as yet be considered a closed one is well evidenced by the fact that there does not as yet exist any decided unanimity, either as regards the pathogenesis or the pathological anatomy, or the therapy of the affection. Although tetanus is one of the diseases that has been known almost from time immemorial, and has been studied by scientific men of all ages, it is really only since the discovery of the specific bacillus by Nicolaier in 1884 that the study of tetanus has received a scientific foundation.

Nature and Varieties of Tetanus.—It may be well at the outset to define tetanus as an acute infectious disease, which is invariably and indubitably caused by the entrance into the body of the specific micro-organism, the Bacillus tetani, discovered by Nicolaier in 1884, and first cultivated in pure culture by Kitasato in 1891 in an anaërobic medium.

[1] Read at the meeting of the New York County Medical Society, April 23, 1900.

Many different varieties are reported upon and described, and have received different names, as tetanus traumaticus, tetanus cephalicus, tetanus puerperalis, tetanus neonatorum, tetanus rheumaticus, tetanus idiopathicus, etc.; but all that can be said of them is, that they are in substance merely varieties of tetanus, which differ only in the place of infection, and as a result may give rise to slight differences in progress and symptomatology. Presuming, however, and of this in the present light of bacteriology and animal experiment, there cannot be the slightest doubt that true tetanus is and must always be caused by the bacillus of Nicolaier, there is certainly no place in the description of a given case of tetanus for the diagnosis "rheumatic" or "idiopathic." The mildest interpretation that can be put is, that in a certain number of cases, fortunately a very small number, either the point of infection has not been searched for with the requisite amount of care, or that it has not been found. That this is quite within the range of possibility is well proven by the fact that tetanus has followed such minute injuries as the introduction of a hypodermic needle, of which there are a number of cases recorded, or the sting of a bee, or a leechbite,[1] which may have healed or apparently healed long before the outbreak of the tetanic symptoms.

It would be proper to require with every diagnosis of tetanus the finding of the bacillus of Nicolaier, but being anaërobic, and in other respects also not easy of cultivation, it would be too much to expect of every general practitioner into whose care these cases mostly come, an exact bacteriological diagnosis. Furthermore, the symptoms in every case of acute tetanus are so well marked and so precise, that none could be mistaken. It is far easier to err on the other side and call a case tetanus which may not be one; carious teeth, periostitis, and osteomyelitis of the jaw, tonsillar and peritonsillar abscesses have been and may be mistaken for tetanus; but in none of these can there be any true symptoms of tetanus;

[1] Tetanus bacilli were found in the snout of a leech by Pacinotti, quoted by Honl.[1]

and it would be manifestly improper to base the diagnosis of tetanus merely upon the locking of the jaws.

Symptomatology.—As a characteristic example of the symptoms of acute tetanus, I cannot do better than describe the case which has come under my observation.

S. G., eighteen years old, a cutter by occupation, was admitted in the evening of July 11, 1899, to the surgical division of Mount Sinai Hospital, with the following history:

On July 4, the patient shot himself in the palm of the hand with a blank cartridge. He immediately applied for treatment at a hospital, at which the wound was disinfected and bandaged; some of the wad was supposed to have been removed at this time. Subsequently, the wound was treated by his family physician, and of the course of the wound between this time and his admission to the hospital only the following facts can be ascertained with a certain degree of accuracy,—moderate discharge from the wound, accompanied by very little pain or tenderness; the fingers were continuously kept in a flexed position, as any attempt at extension was accompanied by pain. On the morning of the 11th (seven days after the injury), the patient noticed for the first time a rigidity of the jaw, with pain at the temporo-maxillary articulation when attempts were made to force the jaws apart; difficulty in swallowing.

Status præsens: Temperature, 99.3° F.; pulse, 90; respirations, 20. Fairly well nourished, rather anæmic individual, who does not give the impression of impending serious illness. In the palmar surface of the left hand, corresponding to the metacarpal bone of the middle finger, a round wound about two or three millimetres in width, the edges of which are covered with a grayish-black deposit; on pressure a small amount of grayish pus oozes from this opening; the fingers are flexed upon the hand and the hand upon the forearm; rigidity of the masseter and temporal muscles, evidenced by the fact that the teeth cannot be separated to a greater distance than about two centimetres; some rigidity also of the muscles of the back of the neck, as the patient cannot approximate the chin to the sternum.

Shortly after admission, at 9 P.M., under cocaine anæsthesia, an incision about one and a half inches long was made over the seat of the infection, and the entire area exposed; the wad of

the cartridge, or at least the greatest part of it, was found still at the bottom of the cavity and was removed; the wall of this cavity had a grayish burned color and contained a large amount of burned powder. Cultures taken from the pus and examined by Dr. Liebman, assistant pathologist of the hospital, gave a negative result; cover-glass preparations revealed a variety of germs, but no unmistakable tetanus bacilli were found. The entire cavity was disinfected with 1 : 500 mercuric chloride solution and a liberal gauze dressing of a weaker solution applied. Internally, sodium bromide and chloral hydrate in thirty and fifteen grain doses respectively were given *pro re nata.*

Between the time of the operation and the following afternoon all the symptoms became progressively more marked; the abdominal muscles were by this time also more or less in a state of contraction, but as yet no alarming symptoms had arisen. At 2 P.M. the dressing was changed and packed with Lugol's solution: the patient received also an intravenous injection of twenty cubic centimetres antitoxin (Paris Institute Pasteur), and at 8 P.M. ten cubic centimetres, while the internal medication of morphine, chloral, and sodium bromide was continued. At this time the patient complained of considerable pain in the back; the muscles of the neck, back, and abdomen were painful and in a state of tonic contraction, with intense pain, cramp like in character; risus sardonicus was marked; the teeth could not be separated for a distance greater than a finger's breadth; there occurred also at short intervals sudden and painful contractions of the masseter muscles, the teeth at such time injuring the tongue. Patient can only swallow in gulps, and at those times only with the greatest difficulty; on this account the sodium bromide and chloral were from this time on administered per rectum, dissolved in forty cubic centimetres physiological salt solution.

During the night there was no remission in the progress of the disease; on the contrary, all symptoms became more marked, and this determined me upon injecting the antitoxin intracerebrally.

At 9.30 A.M. of July 13, under chloroform anæsthesia, a small incision was made, and after drilling with the electric trephine a small opening through the skull, three cubic centimetres of the tetanus antitoxin were injected through a fine hypodermic needle into the anterior lobe. This procedure was repeated on the left

side, using two cubic centimetres of the antitoxin. About seven minutes were consumed for the actual injection on each side.

The patient took the anæsthetic well; pulse and respiration being good throughout; the muscles were well relaxed. On waking, the patient complained constantly of pain, with recurring exacerbations, every ten minutes, cramp like in character. At 4 P.M. the temperature rose to 102.3° F. and the pulse-rate to 130; the rectal medication was continued. There was no diminution of the symptoms after the operation, and at 10.30 P.M. the patient had a clonic convulsion lasting five seconds, which started with a twitching of the facial muscles, becoming general almost immediately, every muscle being apparently affected; the movements were irregular, the body being thrown from one side of the bed to the other. Temperature, 104.4°; pulse, 166. After the convulsion all the muscles were soft and relaxed, the jaws being separable to a distance greater than at any time since the onset of the disease. Patient apparently comatose and does not answer questions, but wakes up at frequent intervals, with a sharp groan, evidently in great pain. At 12.10 A.M. of July 14 the patient had two more convulsions, with marked opisthotonos; when the second attack ceased, the pulse became more rapid and breathing slow and stertorous, and a few minutes later ceased entirely.

A limited autopsy, eighteen hours post mortem, performed by Dr. Mandlebaum, pathologist to the Hospital, showed the following: Marked rigor mortis; in the palm of the left hand an incised wound (site of infection), free from pus and free from any gross changes. From each parietal a small button of bone (five millimetres in diameter) has been removed; dura not adherent, but at site of openings congested. The vessels on the convex surface of the brain distended; fresh thrombi in the longitudinal and lateral sinus, and in the circle of Willis; brain tissue very soft and easily indented; on the right side there was an area of congestion in the pia corresponding to the opening in the parietal bones. The spinal cord showed no gross changes. The microscopical findings will be published on a subsequent occasion.

From a point of prognosis this case belongs to the very worst class; the period of incubation was practically only six days, and its course after the onset of the tetanic symptoms was characterized only by a most acute progress, as there was

not at any time the slightest diminution of the untoward symptoms. The antitoxin was used quite early, the patient receiving the first injection barely seventeen hours after admission to the Hospital, and less than thirty hours after the first appearance of the tetanic symptoms.

The pathological anatomy is not yet fully known in spite of numerous autopsies; many of the recorded autopsies give merely the gross pathological changes in some of the viscera, and show in general insufficient observation. It is to be hoped that the more recent methods of examination of the minute structural changes will throw more light on this subject. Before the advent of this method of examination, the recorded autopsies speak of inflammation and degeneration of the peripheral nerves; anæmia and hyperæmia of the brain and spinal cord; meningeal hæmorrhages; hypertrophic changes of the glia; multiplication of the nuclei in the interstitial connective tissue; inflammatory changes in the sympathetic nervous system.

Autopsies on tetanus patients by competent and trained observers are of so unfrequent occurrence that not much opportunity has as yet been given for the study of the minute structural changes, in the light of modern research; fortunately, however, the lesions of experimental tetanus on tetanized rabbits are so much like those in human tetanus that important analogies can be deduced. A great deal of systematic and valuable work has of late been done by Goldscheider and Flatau, which tends to clear up many of the mooted points regarding the effect of the toxines of tetanus on the nervous system.

Goldscheider and Flatau,[19] in studying the spinal cords of experimentally tetanized rabbits, constantly found certain characteristic changes in the motor cells of the anterior horns, which in the order of their development depend upon the concentration and virulence of the toxins injected and upon the duration of the infection. These changes are readily recognizable by Nissl's method of staining and show primarily an enlargement of the nucleus, which at the same time becomes

more indistinct; then there follows an enlargement and disintegration of Nissl's cell-granules, with an enlargement of all the nerve cells. These authors also found, which is an important hint in respect to the therapy, that when antitoxin has been used, it had a distinct retarding influence on these changes. Goldscheider and Flatau in a subsequent publication [20] verified these changes on the spinal cord of a patient who died of tetanus. Almost similar or only in minor details different results were obtained by Matthes,[21] Westphal,[22] Goebel,[23] and Tauber.[24] The changes related above are characteristic of tetanus and are constantly found.

Our present knowledge of the pathogenesis of tetanus points with great probability to the anterior horns of the spinal cord as the primary seat of origin for the tetanic contractions; hence the constant and characteristic morphological changes found in these cells by Goldscheider and Flatau bear a most important relation to the nature and development of tetanus. It is, however, much to be regretted that our knowledge respecting the structure of the ganglion cells under physiological conditions is still insufficient; while the value of Nissl cell granules is not yet firmly established and universally accepted.

Up to the time of the discovery of the tetanus bacillus by Nicolaier [25] and the successful isolation of the toxins by Brieger and Cohn, Kitasato, etc., the study of tetanus was limited to occasional, few and far between, autopsies at hospitals with attached pathological laboratories, and, as already stated, came to no definite conclusion, and did not aid materially in clearing up the nature of tetanus. Since then, the successful experimental inoculation of the disease into animals, at first by Carle and Rattone in 1884, gave us continual means for the closer study of its pathogenesis.

Stintzing [26] [27] lays particular stress upon the fact that in all forms of experimental tetanus there is always found, before the disease has been fully developed, a contraction of the muscles in that part of the body where the infection has taken place. This is the so-called local tetanus; and he says

that it has never been observed in human tetanus. As a matter of fact, there is not the slightest doubt in my mind that it does occur also at an early stage in human tetanus, only that it is frequently overlooked on account of the fact that, as a rule, we but rarely have an opportunity to see the affected patient at so early a stage, since we get them only when the disease is far more advanced, and when this symptom has already disappeared. It certainly was one of the marked symptoms in the case under my observation, and was so pronounced that even the patient himself, otherwise of but a fair order of intelligence, distinctly so stated it in the anamnesis, without my calling his attention to this point.

This local tetanus occurs regularly and without exception in all cases of experimental tetanus, and consists of regular contractions and rigidity in the muscles nearest to the seat of infection, while the remaining muscles are affected only much later. If the intoxication is only of a milder character, the tetanus may even remain limited to the first group of muscles, without involving the rest of the body.

The explanation of this local tetanus is by no means easy, and was an important point in the research of tetanus, and even now is not entirely a settled matter.

At first it was definitely decided that the brain is not the place of origin for the tetanic spasms, as it was shown by decapitation that animals still continued to have the tetanic spasms, so there remained only the normal reflex arch, *i.e.*, sensory nerves, spinal cord, motor nerves, and muscles.

Muscles and motor nerves have been excluded by curare and division experiments.

The experiments of Autokratow, which were confirmed by Courmont and Doyon (*loc. cit.*), lay considerable stress upon the sensory nerves, as these experimenters have found that tetanus did not arise after division of the sensory nerves leading from the extremity experimented upon. A directly opposite result, however, was obtained by Brunner [28] [29] [30] [31] and Gumprecht; [32] as these observers found that local tetanus did

arise when the posterior nerve-roots belonging to the sensory nerves leading from the extremity experimented upon were divided. (Gumprecht explains this important divergence in the results by the possibility that in the experiments of Courmont and Doyon there remain motor nerve-roots, or by a diminished reflex irritability, due to a lowering of the vitality, induced by the extent of the operation.) With such conflicting evidence, it is certainly more proper to give more weight to the positive results of Brunner and Gumprecht than to the negative results of Courmont and Doyon. If this is accepted as proven, there remains only the spinal cord, which must be looked upon as the source of the tetanic spasms. Brunner finishes his *résumé* by stating that if the spinal cord is looked upon as the source of the tetanic spasms, it is but rational to assume that the true source is in the motor ganglia cells of the anterior horns, and that there exists a specific affinity in these cells for the tetanic toxins.

If this theory for the mechanism of general tetanus is accepted, we must still find a cogent and acceptable explanation for the local symptoms which arise constantly and without exception in experimental tetanus on animals, and, as already stated, probably also in man. If we assume what at first sight seems most probable, that the toxins generated by the bacilli at the point of infection are absorbed and get into the general circulation, then the spasms would necessarily be general and symmetrical from the very onset, or, at all events, without any special seat of predilection; but the fact that local tetanus constantly arises in animal experiments upsets this theory. This local tetanus received at first the explanation that it arises as a result of an irritation from the wound in the muscles nearest to the point of infection, either in consequence of the local action of the bacteria or of the wound itself, or its secretions. The probability, however, is far greater that the toxins are carried along the neighboring nerves to the spinal cord, and primarily excite to greater reflex irritability that segment of the cord in which these nerves take their origin. The

inoculation into a nerve-trunk proper by Tizzoni and Cattani has also given positive results.

From these experiments, we may assume with a certain degree of probability that the tetanic toxins assert their action in that place primarily and most quickly where they are first deposited in a somewhat concentrated form; and, as it has been proven that the peripheral nerves are not the seat of the infective process, then we must also presume that the toxins must first be taken by the channels of the peripheral nerves to the corresponding spinal segment. Proof for this would be positive, if we would constantly find the toxins in the peripheral nerves, and if we could constantly induce tetanus by implanting bits of the peripheral nerves into animals. As a matter of fact, this, however, does not occur constantly, which point is explained by Wassermann and Takaki [33] by the fact that the normal brain and cord have a certain tetanus antitoxic power.

The hypothesis of nerve conduction for the tetanic poison is therefore still without a solid foundation, particularly when it is taken into consideration that there still remains, at least in animals, one constant method of conduction for the tetanus poison, *i.e.*, the circulation, because in all animal experiments the blood has always been found to have tetanus toxic properties. To carry out, however, the hypothesis of nerve conduction, we are compelled to assume as correct the theory of Gumprecht (*loc. cit.*), that there are in every case two methods of dissemination for the toxins, one, the first one, along the peripheral nerves to the spinal cord, which is the cause of the so-called local tetanus, followed after a shorter or longer interval by general tetanus, and caused by infection of the central nervous system through the channel of the circulation. The fact that, when the intoxication is but a mild one, the entire process may be limited to the local tetanus would add additional weight to this hypothesis.

Of late, Stintzing (*loc. cit.*) has published a series of observations which tend to throw light on some of the mooted questions of tetanus. He investigated the toxic properties of the cerebrospinal fluid obtained by means of lumbar

puncture in two grave cases of tetanus. Inoculation of this cerebrospinal fluid into mice was always followed by true tetanus, but with the remarkable fact that it occurred at different periods; the incubation period being respectively one, two, nine, and twenty-six days. This led to the one assumption that the cerebrospinal fluid had various degrees of toxicity; another remarkable fact which Stintzing has observed in both these cases is that, contrary to animal experiments, the blood of these patients inoculated into animals did not prove to be toxic. This, however, is not surprising, as similar observations have previously been noted by Moritz,[34] Henoch,[35] Engelmann,[36] Kallmeyer,[37] and Tauber;[38] while a positive result was obtained by very few observers only, as Blumenthal and a few others. Stintzing, from this observation, though he will not deny the toxicity of the blood, is quite positive that the cerebrospinal fluid always contains the toxins in more active and in stronger concentration than does the blood.

If Stintzing's observation is proven to be a fact, then the theory of nerve conduction receives a stronger foundation in the greater and more constant toxicity of the cerebrospinal fluid; particularly if we take into consideration the anatomical fact that the subarachnoidal space which contains the cerebrospinal fluid is always in communication on one side with the interstices of the perineurium externum and internum, and on the other side with the interstices of the spinal cord.

One would naturally expect that so important a point should and could be also proven by animal experiment; but there are almost insurmountable difficulties because of the impossibility to obtain large quantities of cerebrospinal fluid by lumbar puncture in consequence of the small calibre of the spinal canal in animals.

If the presumption be a correct one, that the tetanus toxins are brought to the subarachnoidal space, respectively to the spinal cord, by means of the perineural and endoneural lymph channels, and so exert their toxic influence, it would still not explain the occurrence of local tetanus. It could be said, in counterargument, that the toxins may become rapidly

disseminated through the subarachnoidal space, and that consequently they act generally, but not locally, on the cord. But this is counteracted by the fact, as Stintzing (*loc. cit.*) explains it, that the production of the toxins takes place but slowly at the seat of infection, that therefore the inflow of toxins occurs only slowly, so to say, drop by drop. It is therefore not at all surprising that the toxins are taken up at once on their entrance by the nearest cells of the anterior horns, because of their specific affinity for this poison, before they had an opportunity to become diffused, and in this manner produced at first the "local" tetanus. Following out this line of argument, the later regional progress of the contractions, *i.e.*, at first in a transverse, then in ascending and descending direction, could be well explained; because it could be assumed that, after a saturation of the nearest motor cells, the poison would spread to adjoining groups. The fact that occasionally, in milder cases, the process is limited to the group of muscles first affected could also be brought into harmony by the assumption that only sufficient poison was produced to saturate the first group of cells.

This hypothesis, which, however, has a large amount of probability, would fully explain all the phenomena of experimental tetanus in animals, and for that matter also those of tetanus in men, with the exception that local tetanus is not observed so regularly in men. Stintzing attempts a very plausible explanation of this phenomenon, also, in the difference in size of the subarachnoidal space in men and animals, as it is evident that the toxins would be more slowly diffused in the comparatively narrow and tight channel of animals than in the wider channel of men. The rapid diffusion after its influx in men would also explain the early distribution of the spasms.

Stintzing sums up his research in the following: "The tetanus bacillus produces toxins at the seat of infection. These toxins get partly into the circulation (in animals surely) and may become active through this channel; as a rule, however, the toxins are carried along the nearest nerves, presumably in the meshes of the perineurium and endoneurium to the spinal

cord. On reaching the subarachnoidal space of the cord they produce in animals their toxic action at first at the point of entrance into the cord, and so cause the "local" tetanus. If sufficient poison is brought to the spinal cord, it produces next a regionary and, finally, general tetanus. The same *may* be true for human tetanus. Most frequently, however, in man the spasms are produced without any order, presumably because the toxins are diffused rapidly through the comparatively larger and loosely fitting subarachnoidal space. The point of attack for the toxins is certainly the motor ganglia cells of the anterior horns, which get into a state of increased reflex irritability by the action of the toxins.

The prognosis of tetanus is of the greatest importance in any given case; observation of a large number of cases, both in peace and war surgery, has taught us amply that the prognosis of any given case is particularly dependent upon two factors; viz.:

(1) The period of incubation.

(2) The rapidity of development of the symptoms, *i.e.*, the progress of the disease.

Regarding the first point, which can be obtained with the utmost accuracy in a majority of the cases, experience has taught that the shorter the period of incubation the worse is the prognosis; this statement is made in general, as in a measure, though a subordinate one, it is also dependent upon the second factor; but the observation in general has also shown that usually cases with a briefer period of incubation are also those in which the development of the symptoms is more acute and progress more rapid.

Many scattered statistical reports regarding the prognosis of tetanus are found in the literature. I will mention here only those found most frequently quoted.

Richter, quoted by Rotter,[39] in a statistic of 224 cases of tetanus following mostly wounds and injuries during the Franco-Prussian war, gives the following values in regard to prognosis:

Of 25 cases with a period of incubation of 1-5 days there were 4 per cent. recoveries.

Of 91 cases with a period of incubation of 6-10 days there were 4.4 per cent. recoveries.

Of 54 cases with a period of incubation of 11-15 days there were 27 per cent. recoveries.

Of 20 cases with a period of incubation of 15-20 days there were 45 per cent. recoveries.

Of 15 cases with a period of incubation of over 20 days there were 20 per cent. recoveries.

Almost similar values have been obtained by Poland (quoted by Rose [40]), who has collected his statistics from various London hospitals, viz.:

25 cases with a period of incubation of 1-5 days gave 4 per cent. recoveries.

61 cases with a period of incubation of 1-10 days gave 3.3 per cent. recoveries.

44 cases with a period of incubation of 10-22 days gave 25 per cent. recoveries.

6 cases with a period of incubation of over 22 days gave 50 per cent recoveries.

Richter, in a collection of 717 cases of tetanus caused by various injuries of war surgery, records 631 deaths, or a mortality of 88 per cent., with 40 recoveries, equalling 12 per cent.; and of these 40, 13 were of a milder variety.

Behring gives for tetanus a mortality of 80-90 per cent.

Raymond gives for tetanus a mortality of 90.5 per cent.

Fronz gives for Tetanus neonatorum a mortality of 50 per cent.

Larrey gives for Tetanus neonatorum a mortality of 50 per cent.

The records of the Bürger Hospital at Cologne give for tetanus a mortality of 62.5 per cent.

Garrigues [41] gives for 57 cases of puerperal tetanus a mortality of 84-92 per cent.

Gowers [42] gives for traumatic tetanus a mortality of 90 per cent.

Dean [43] gives for all cases of tetanus in various London hospitals, for a period of sixteen years, a mortality of 80 per cent.

A special committee,[44] appointed by the *British Medical Journal,* came to the conclusion that acute tetanus is incurable, and that, although anodynes and hypnotics sometimes afforded alleviation, there was known no remedy for it. They also found that between 1875 and 1892 there occurred in England and Wales 2969 deaths from traumatic tetanus, and between 1881 and 1892, 568 deaths from so-called idiopathic tetanus.

That tetanus is quite common and quite commonly fatal is shown also by the quotation [45] that there occurred in Greater New York during 1898, 73 deaths from tetanus.

Albertoni,[46] in a collection gathered by one of his students, gives a remarkable statistic in which he claims that tetanus is not the fatal disease it is claimed to be, and for 176 cases treated with 46 methods(?) of treatment gives 139 recoveries; equalling a mortality percentage of 21.1 per cent., and a percentage of recoveries of 78.9 per cent.

With the exception of the last quoted figures, all statistics show almost conclusively that when the period of incubation is very short, less than ten days, the percentage of recoveries is very small, on an average no more than 5 per cent.; and also that the prognosis improves with each day beyond this period, and may reach even as high as 50 per cent.

The above figures are fair examples, and may be considered as correct up to the last decennium. The prognosis of tetanus, however, certainly needs some revision in the light of modern treatment, *i.e.,* since the introduction of serum therapy in the treatment of tetanus. Many cases are reported as cured even when the period of incubation has been of a shorter duration than ten days.

Of the various statistics collected since the introduction of the antitoxin, I will only mention the following:

Marson [47] publishes the statistics of 38 cases, collected from different observers, with a mortality of 13 or 34.2 per cent.

Hewlet [48] collected 42 cases treated with antitoxin, with a mortality of 36 per cent.

Engelmann [36] publishes a statistic of 54 cases, treated with antitoxin of different makes (36 with Tizzoni's, 5 with Behring's, and 13 unnamed) with a mortality of 16, or 29.63 per cent.

Kanthack [49] collected 54 cases, of which 20 died, or a mortality of 37.03 per cent.

Wellner [50] collected 94 cases, of which 41 died, or a mortality of 45 per cent.

Köhler [51] collected 96 cases, of which 33 died and 63 recovered, or a mortality of 34.3 per cent.

Weischer [52] collected 98 cases, with a mortality of 41.8 per cent.

Lambert [53] collected 114 cases, of which 46 died, or a mortality of 40.35 per cent.

Lund [54] collected 167 cases, of which 54 died, or a mortality of 39.5 per cent.

Holsti [55] collected 171 cases, of which 74 died, or a mortality of 43.2 per cent.

After a painstaking and extensive search in the literature of the past ten years, utilizing for this purpose all the publications at my command, in which there was a possibility of a case being reported, I have been able to collect the following cases:

CASES TREATED BY SUBCUTANEOUS OR INTRAVENOUS INJECTIONS.

No. 1.—*Name,* Schwartz.[85] *Year,* 1891. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of forearm. *Period of incubation,* fifteen days. *Day of first injection,* fourteenth day. *Method of administration,* subcutaneous. *Amount,* 1.0. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery.

No. 2.—*Name,* Baginsky.[86] *Year,* 1891. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of navel. *Period of incubation,* eighth day of life. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 1.5. *Make,* Tizzoni, serum of immunized rabbit. *Other treatment,* not stated. *Result,* death. *Remarks.* Author says he never saved a case of Tetanus neonatorum; although Henoch, Saltmann, and Monti claim to have done so with chloral, physostigma, and musk.

No. 3.—*Name,* Finotti.[87] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of hand. *Period of incubation,* eleven days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 4.75. *Make,* Tizzoni, dog's serum. *Amount,* 0.40. *Make,* Tizzoni, rabbit's serum. *Other treatment,* morphine. *Result,* recovery.

No. 4.—*Name,* Finotti.[88] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of forearm. *Period of incubation,* fifteen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 4.80. *Make,* Tizzoni. *Other treatment,* none. *Result,* recovery. *Remarks.* Author says, to judge from the symptoms, a very bad case, in spite of the long period of incubation; recovery due entirely to the antitoxin.

No. 5.—*Name,* Berger.[89] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of little finger. *Period of incubation,* fourteen days. *Day of first injection,* thirty-eighth day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Roux. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Evidently a very mild case, if patient lived thirty-eight days after the onset of the symptoms. Author will not say whether recovery was due to the antitoxin or to the amputation.

No. 6.—*Name,* Polaillon.[90] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of leg. *Period of incubation,* three weeks. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* not stated. *Other treatment,* not stated. *Result,* death. *Remarks.* According to author, a medium grave case.

No. 7.—*Name,* Taruffi.[91] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of little finger. *Period of incubation,* eleven days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 1.5. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Author says recovery was undoubtedly due to the antitoxin.

No. 8.—*Name,* Casali.[92] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot by a piece of wood, followed by a phlegmon and lymphangitis. *Period of incubation,* eight days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 140 cubic centimetres. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says recovery was due solely to the antitoxin, in spite of the fact that it was used comparatively late.

No. 9.—*Name,* Tizzoni.[93] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of finger. *Period of incubation,* twelve days. *Day of first injection,* tenth day. *Method of administration,* subcutaneous. *Amount,* 37 cubic centimetres and 1.35 dry. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery.

No. 10.—*Name,* Renon.[94] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of posterior auricular region. *Period of incubation,* six days. *Day of first injection,* first day. *Method*

of administration, subcutaneous. *Amount,* 57 cubic centimetres. *Make,* Tizzoni, rabbit's serum. *Other treatment,* not stated. *Result,* death.

No. 11.—*Name,* Renon.[94] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of little finger. *Period of incubation,* seven days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 80 cubic centimetres. *Make,* Tizzoni, rabbit's serum. *Other treatment,* chloral. *Result,* death.

No. 12.—*Name,* Pacini.[95] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of finger, caused by a scythe. *Period of incubation,* ten days. *Day of first injection,* fifteenth day. *Method of administration,* subcutaneous. *Amount,* 2.0. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery.

No. 13.—*Name,* Gagliardi.[96] *Year,* 1892. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of foot. *Period of incubation,* twelve days. *Day of first injection,* twelfth day. *Method of administration,* subcutaneous. *Amount,* 1.05. *Make,* Tizzoni. *Other treatment,* morphine, chloral, Baccelli. *Result,* recovery.

No. 14.—*Name,* Finotti.[97] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of neck by a piece of wood. *Period of incubation,* about twenty-three days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 2.70. *Make,* Tizzoni. *Other treatment,* some morphine, some chloral. *Result,* recovery. *Remarks.* No tetanus bacilli could be cultivated from the wound; but they were cultivated from the wood removed from the wound. Author thinks that recovery was due entirely to the antitoxin.

No. 15.—*Name,* Lesi.[98] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of foot, caused by a piece of glass. *Period of incubation,* six days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 100 cubic centimetres. *Make,* Tizzoni. *Other treatment,* chloral, antipyrine, pilocarpine, but none after injections were begun. *Result,* recovery. *Remarks.* Author says it was a bad case in all respects, followed by ultimate recovery, which was unquestionably due to the antitoxin.

No. 16.—*Name,* Henoch.[99] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of hand. *Period of incubation,* not obtainable. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 30 cubic centimetres. *Make,* Behring. *Other treatment,* morphine, anæsthetics. *Result,* death. *Remarks.* Author says that the death in this case does not in the least speak against the use of antitoxin.

No. 17.—*Name,* Moritz.[100] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* numerous wounds on both hands. *Period of incubation,* not obtainable. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 95.0. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Author says that, judging from the symptoms, this case belongs to the more chronic or subacute variety.

No. 18.—*Name,* von Ranke.[101] *Year,* 1893. *Diagnosis,* Tetanus trau-

maticus. *Nature of injury,* injury of foot, caused by a piece of wire. *Period of incubation,* about three weeks. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Behring. *Other treatment,* chloral. *Result,* recovery. *Remarks,* Author will not say what effect the antitoxin had, as a good prognosis was given even before its use.

No. 19.—*Name,* von Ziemssen.[102] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of foot, caused by a piece of glass. *Period of incubation,* seven to eight days. *Day of first injection,* fifteenth day. *Method of administration,* subcutaneous. *Amount,* 100 cubic centimetres. *Make,* Behring. *Other treatment,* purposely none. *Result,* recovery. *Remarks.* Author says, only a medium grave case, with no unfavorable prognosis; hence he will not give too much credit to the antitoxin, and believes case would have recovered even without it.

No. 20.—*Name,* Brunner.[103] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by a nail. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 100 cubic centimetres. *Make,* Behring. *Other treatment,* morphine. *Result,* death. *Remarks.* Author says undoubtedly a bad case; is not at all enthusiastic about the antitoxin.

No. 21.—*Name,* Baginsky.[104] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of tongue, not diphtheritic. *Period of incubation,* unknown. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 72 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, etc. *Result,* recovery. *Remarks.* Case was, however, also complicated by true diphtheria.

No. 22.—*Name,* Escherich.[105] *Year,* 1893. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of umbilicus. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 0.03. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* death.

No. 23.—*Name,* Escherich.[105] *Year,* 1893. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of umbilicus. *Period of incubation,* twelve days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 0.5. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* death.

No. 24.—*Name,* Escherich.[105] *Year,* 1893. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of umbilicus. *Period of incubation,* eleven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 0.9. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery.

No. 25.—*Name,* Escherich.[105] *Year,* 1893. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of umbilicus. *Period of incubation,* five days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 0.9. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death.

No. 26.—*Name,* Gattai.[106] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of thumb. *Period of incubation,* six days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 22 cubic centimetres. *Make,* Tizzoni, rabbit's serum, also 475 cubic centimetres; Tizzoni, dog's serum, and 29 cubic centimetres; Tizzoni, horse's serum. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says that, judging from the period of incubation and symptoms, it was a very bad case; recovery due only to early use and large quantity of antitoxin.

No. 27.—*Name,* Magagni.[107] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contused wound of toe. *Period of incubation,* eight days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 2.75. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery.

No. 28.—*Name,* Buschke and Oergel.[108] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of leg, caused by kick of a horse. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10 cubic centimetres. *Make,* Behring. *Other treatment,* not stated. *Result,* death. *Remarks.* Patient survived injection only one-half an hour.

No. 29.—*Name,* Rotter.[109] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of hand. *Period of incubation,* eight days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 261 cubic centimetres. *Make,* Behring. *Other treatment,* 0.01 morphine once only. *Result,* recovery. *Remarks.* Author says recovery was due solely to the use of antitoxin, as only one dose of morphine was given.

No. 30.—*Name,* Barth.[110] *Year,* 1893. *Diagnosis,* Tetanus(?). *Nature of injury,* unknown. *Period of incubation,* unknown. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 275 cubic centimetres. *Make,* Behring. *Other treatment,* chloral and KBr. *Result,* recovery. *Remarks.* Author says that, judging from symptoms and period of incubation, it was a very bad case; regrets his inability to find seat of infection.

No. 31.—*Name,* Roux and Vaillard.[111] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* extraction of tooth. *Period of incubation,* fifteen days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 147 cubic centimetres. *Make,* Roux. *Other treatment,* chloral. *Result,* death.

No. 32.—*Name,* Roux and Vaillard.[111] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* cartridge injury. *Period of incubation,* eight days. *Day of first injection,* fourteenth day. *Method of administration,* subcutaneous. *Amount,* 108 cubic centimetres. *Make,* Roux. *Other treatment,* not stated. *Result,* death.

No. 33.—*Name,* Roux and Vaillard.[111] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of hand. *Period of incubation,* five days. *Day of first injection,* first day. *Method of administration,* subcutaneous, intravenous. *Amount,* 20 cubic centimetres.

10 cubic centimetres. *Make,* Roux. *Other treatment,* not stated. *Result,* death.

No. 34.—*Name,* Roux and Vaillard.[111] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* numerous (engine) injuries. *Period of incubation,* eight days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 402 cubic centimetres. *Make,* Roux. *Other treatment,* chloral, morphine. *Result,* death.

No. 35.—*Name,* Roux and Vaillard.[111] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of finger. *Period of incubation,* fourteen days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 247 cubic centimetres. *Make,* Roux. *Other treatment,* chloral. *Result,* death.

No. 36.—*Name,* Roux and Vaillard.[111] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of hand. *Period of incubation,* fifteen days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 265 cubic centimetres. *Make,* Roux. *Other treatment,* chloral. *Result,* recovery.

No. 37.—*Name,* Berger.[113] *Year,* 1893. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* unknown. *Period of incubation,* not stated. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 280 cubic centimetres. *Make,* serum of immune horse. *Other treatment,* large doses of chloral. *Result,* death.

No. 38.—*Name,* Dean.[113] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of finger. *Period of incubation,* twenty-five days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 15.75. *Make,* Tizzoni. *Other treatment,* morphine, chloral. *Result,* recovery. *Remarks.* Author will not express an opinion regarding the severity of the case; believes the antitoxin was quite an aid in the treatment.

No. 39.—*Name,* Evans.[114] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound over knee. *Period of incubation,* eight days. *Day of first injection,* tenth day. *Method of administration,* subcutaneous. *Amount,* 4.5. *Make,* Tizzoni. *Other treatment,* morphine, chloral, bromides. *Result,* recovery.

No. 40.—*Name,* Fanning.[115] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by stepping on a nail. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Roux. *Other treatment,* not stated. *Result,* death. *Remarks.* Author says death resulted in spite of the early use of antitoxin.

No. 41.—*Name,* Parker.[116] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of thumb. *Period of incubation,* four to five weeks. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 5.625. *Make,* not stated. *Other treatment,* Baccelli. *Result,* recovery. *Remarks.* Undoubtedly a case of chronic tetanus; but the antitoxin was of considerable value, according to author.

No. 42.—*Name,* Clarke.[117] *Year,* 1894. *Diagnosis,* Tetanus trau-

maticus. *Nature of injury,* crushed wound of thumb. *Period of incubation,* one week. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 15.0. *Make,* Roux. *Other treatment,* chloral and KBr. *Result,* recovery. *Remarks.* Author says it is only reasonable to ascribe the recovery to the antitoxin, as the drugs appeared to have little or no effect.

No. 43.—*Name,* Paget.[118] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Roux. *Other treatment,* not stated. *Result,* death.

No. 44.—*Name,* Giusti and Bonaiuti.[119] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* extensive injuries of face and body after railroad collision. *Period of incubation,* twenty-two days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 80.0. *Make,* Tizzoni, horse's serum, also 110 cubic centimetres. *Make,* Tizzoni, dog's serum. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says that, judging from symptoms, it was a very bad case, cured only by the antitoxin.

No. 45.—*Name,* Bauer.[120] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of foot. *Period of incubation,* seven days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 2.25. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* death. *Remarks.* Patient survived injection only by a few hours.

No. 46.—*Name,* Doerfler.[121] *Year,* 1894. *Diagnosis,* Tetanus(?). *Nature of injury,* unknown. *Period of incubation,* unknown. *Day of first injection,* tenth day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Behring. *Other treatment,* chloral and morphine. *Result,* recovery. *Remarks.* Author says, a medium grave case with good prognosis, and will not draw conclusions regarding the efficacy of the antitoxin.

No. 47.— *Name,* E. Schwartz.[122] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* pustule of leg. *Period of incubation,* unknown. *Day of first injection,* second day. *Method of administration* subcutaneous. *Amount,* 4.0. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death. *Remarks.* Patient died suddenly. Autopsy showed parenchymatous degeneration of myocardium.

No. 48.—*Name,* Tavel.[123] *Year,* 1894. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* wound of face, caused by kick of a horse. *Period of incubation,* seven days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 120 cubic centimetres. *Make,* Tavel. *Other treatment,* chloral. *Result,* recovery.

No. 49.—*Name,* Remesoff and Fedoroff.[124] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by stepping on a nail. *Period of incubation,* about eight days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 200 cubic centimetres. *Make,* author's. *Other treatment,* chloral and NaBr. *Result,* recovery.

No. 50.—*Name,* Remesoff and Fedoroff.[124] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* possibly from scratch of a cat. *Period of incubation* unknown. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 150 cubic centimetres. *Make,* author's. *Other treatment,* chloral and NaBr. *Result,* death. *Remarks.* Cause of death, pneumonia.

No. 51.—*Name,* von Hacker.[125] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of palm. *Period of incubation,* eleven days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 8.85. *Make,* Tizzoni. *Other treatment,* narcotics. *Result,* recovery. *Remarks.* Author says that both were bad cases, in spite of the apparently long period of incubation.

No. 52.—*Name,* von Hacker.[125] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of thumb. *Period of incubation,* unknown. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 4.05. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery.

No. 53.—*Name,* Marson.[126] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of thumb. *Period of incubation,* ten days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 136 grains. *Make,* not stated. *Other treatment,* chloral, KBr, physostigma. *Result,* death. *Remarks.* Author believes there was a beneficial effect of the antitoxin on the spasms; and gives expression to the thought that the death may have been due to sepsis.

No. 54.—*Name,* Marriott.[127] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of chin. *Period of incubation,* six days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 8.7. *Make,* Tizzoni. *Other treatment,* chloral, morphine, physostigma. *Result,* recovery. *Remarks.* Author thinks recovery was due to the antitoxin.

No. 55.—*Name,* Fenwick.[128] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contused wound of thumb. *Period of incubation,* ten days. *Day of first injection,* thirteenth day. *Method of administration,* subcutaneous. *Amount,* 16.055. *Make,* not stated. *Other treatment,* chloral, morphine. *Result,* recovery.

No. 56.—*Name,* Williamson.[129] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* extensive burns and lacerated wound of buttock. *Period of incubation,* eleven days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 111 grains. *Make,* Tizzoni. *Other treatment,* morphine. *Result,* death. *Remarks.* Author says that the antitoxin appeared to be neither beneficial nor hurtful; the disease, though slow, pursuing an ordinary course. Although the treatment was begun early, its failure was probably due to even that period being too late.

No. 57.—*Name,* Gornall.[130] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of leg. *Period of incubation,* twelve days. *Day of first injection,* second day. *Method of administra-*

tion, subcutaneous. *Amount,* 11.0. *Make,* Tizzoni. *Other treatment,* chloral and KBr. *Result,* recovery.

No. 58.—*Name,* Turner and Cheatle.[131] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of thumb by a barbed wire. *Period of incubation,* about eight days. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 3.5. *Make,* British Institute of Preventive Medicine. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Author says that, judging from period of incubation, the case was a grave one, but from the symptoms it was of a milder type. But he also says that no drug would have arrested the disease like the antitoxin did.

No. 59.—*Name,* Farrant.[132] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of face, caused by kick of a horse. *Period of incubation,* five days. *Day of first injection,* tenth day. *Method of administration,* subcutaneous. *Amount,* 74 grains. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr, morphine, etc. *Result,* death.

No. 60.—*Name,* Tirard.[133] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of foot, caused by a piece of glass. *Period of incubation,* about a fortnight. *Day of first injection,* about tenth day. *Method of administration,* subcutaneous. *Amount,* 60 grains. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says that certainly after the antitoxin the child was more peaceful and the opisthotonos spasm was less.

No. 61.—*Name,* Hartley.[134] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of forearm, caused by a nail. *Period of incubation,* thirteen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 8.0. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr, hyoscyamus, cannabis indica. *Result,* recovery. *Remarks.* Author says it is doubtful whether either the antitoxin or the chloral had anything to do with the favorable result.

No. 62.—*Name,* Oelberg.[135] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of foot. *Period of incubation,* about fourteen days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 1.65. *Make,* Tizzoni. *Other treatment,* large doses of morphine and chloral. *Result,* death.

No. 63.—*Name,* Firth.[136] *Year,* 1895. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of umbilicus. *Period of incubation,* eight days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 2.0. *Make,* not stated. *Other treatment,* KBr and chloral. *Result,* death. *Remarks.* Author says no improvement whatsoever followed the injections.,

No. 64.—*Name,* Pel.[137] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* slight injury of foot. *Period of incubation,* eight days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 9.0. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Author says that recovery was not dependent upon the treatment.

No. 65.—*Name,* Granowsky.[138] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of palm. *Period of incubation,* nine days. *Day of first injection,* thirteenth day. *Method of administration,* subcutaneous. *Amount,* 25 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, NaBr. *Result,* recovery. *Remarks.* Case does not prove anything, as patient was almost well when injections were begun.

No. 66.—*Name,* Thompson.[139] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of foot by iron spike. *Period of incubation,* about two and a half weeks. *Day of first injection,* not stated. *Method of administration,* subcutaneous. Toxins. *Result,* recovery. *Remarks.* Author gives the history of the case in detail up to the thirteenth day of the disease. On this day he says, "I succeeded in obtaining from the Loomis laboratory a tetanus toxin made after the method of Brieger, that is, it was developed by growing fresh tetanus germs in a strong bouillon, and the boy received daily for five days inoculations of from one-half to one cubic centimetre, which were placed in the gluteal region." Also chloral, morphine, urethan, conium, etc. Ultimately the case recovered completely. Regarding the benefit he obtained, the author says, "I confess myself somewhat in doubt in regard to it; they (the injections) certainly did no harm."

It is true, somewhat late in the disease cultures were made from the vicinity of the scar, result negative; negative results also on attempting a culture with the blood. But cultures made from the scrapings around the hole of the boot, and from the earth of the yard where the patient lived, did develop cultures of tetanus. (These experiments prove nothing, as cultures from a cicatrix and blood are not necessarily positive; while the other positive results may be so, nay, are very likely to be so; but the patient must not necessarily have tetanus.) Author also says that tetanus bacilli grow in all media, both with and without oxygen; but all observers agree that the tetanus bacillus is positively anaërobic.

Though author argues for the correctness of his diagnosis, and differentiates it from hysteria, it may have been a wrong diagnosis. Even if it was tetanus, it was not proven, as author believes, by the culture experiments. And if it was a case of tetanus, it could not have been cured by the injections, as the author injected tetanus toxins, not antitoxin.

No. 67.—*Name,* Miti.[140] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot. *Period of incubation,* three days. *Day of first injection,* eleventh day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says unquestionably a very bad case, with very short period of incubation; cured only by the antitoxin.

No. 68.—*Name,* Illuminati.[141] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of foot. *Period of incubation,* thirteen days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery.

No. 69.—*Name,* Douglas.[142] *Year,* 1894. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* dog-bite of thumb. *Period of incubation,* five days. *Day of first injection,* sixth day. *Method of administration,*

subcutaneous. *Amount,* ½ tube. *Make,* Tizzoni. *Other treatment,* chloral, morphine, eserine. *Result,* death. *Remarks.* Author argues for the diagnosis, though hydrophobia is not excluded. His arguments are the early appearance of the trismus, the absence of delirium, and the fact that the dog remained well up to the time of publication, six weeks after the accident. Author regrets not having used the antitoxin earlier.

No. 70.—*Name,* Caretti.[143] *Year,* 1895. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* crushed and lacerated wound of temporal region. *Period of incubation,* eight days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 9.0. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery.

No. 71.—*Name,* Walko.[144] *Year,* 1895. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* tamponade of uterus for post-partum hæmorrhage. *Period of incubation,* nine days. *Day of first injection,* fourth day, *Method of administration,* subcutaneous. *Amount,* 3.6. *Make,* Tizzoni. *Other treatment,* none, on purpose. *Result,* death.

No. 72.—*Name,* Vagedes.[145] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of finger. *Period of incubation,* about eight days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 30.0. *Make,* Behring. *Other treatment,* choral. *Result,* recovery. *Remarks.* Author says case was a mild one, hence will not say how much the recovery was due to the antitoxin.

No. 73.—*Name,* Preindlsberger.[146] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of finger. *Period of incubation,* six days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 0.425. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* death. *Remarks.* Tetanus bacilli found in the wound secretions.

No. 74.—*Name,* Preindlsberger.[146] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of foot. *Period of incubation,* thirteen days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 7.39. *Make,* Tizzoni. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks,* Author will not say how far recovery was due to the antitoxin.

No. 75.—*Name,* Howlett.[147] *Year,* 1895. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* gunshot injury of leg. *Period of incubation,* nineteen days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 22½ grains. *Make,* not stated. *Other treatment,* chloral, KBr, cannabis indica. *Result,* recovery. *Remarks.* Author praises the good effect of the antitoxin.

No. 76.—*Name,* Foges.[148] *Year,* 1895. *Diagnosis,* Tetanus(?). *Nature of injury,* not discoverable. *Period of incubation,* unknown. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 2.4. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death.

No. 77.—*Name,* Willemer.[149] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* scratch wound of neck. *Period of incubation,* four days. *Day of first injection,* seventh day. *Method of administration,*

subcutaneous. *Amount*, 9.0. *Make*, Behring. *Other treatment*, morphine, chloral. *Result*, recovery. *Remarks*, Author looks upon the case as a grave one.

No. 78.—*Name*, Ridge.[150] *Year*, 1896. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, lacerated wound of finger and thumb. *Period of incubation*, thirteen days. *Day of first injection*, eighth day. *Method of administration*, subcutaneous. *Amount*, 13.0. *Make*, British Institute of Preventive Medicine. *Other treatment*, chloral, KBr. *Result*, recovery.

No. 79.—*Name*, Fenwick.[151] *Year*, 1896. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, lacerated wound of hand, with subsequent gangrene. *Period of incubation*, thirteen days. *Day of first injection*, second day. *Method of administration*, subcutaneous. *Amount*, 3.0. *Make*, not stated. *Other treatment*, morphine. *Result*, death. *Remarks*. Author thinks the antitoxin increased the spasms instead of diminishing them.

No. 80.—*Name*, Baker.[152] *Year*, 1896. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, lacerated wound of groin, inflicted by the horn of a buffalo. *Period of incubation*, some few days. *Day of first injection*, seventh day. *Method of administration*, subcutaneous. *Amount*, 3.0. *Make*, British Institute of Preventive Medicine. *Other treatment*, chloral, KBr, hyoscyamus, physostigma. *Result*, death. *Remarks*. Author says no amelioration followed the injections; on the contrary, patient got worse.

No. 81.—*Name*, Baker.[153] *Year*, 1896. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, incised wound of leg, caused by a piece of glass. *Period of incubation*, ten days. *Day of first injection*, second day. *Method of administration*, subcutaneous. *Amount*, 6.5. *Make*, British Institute of Preventive Medicine. *Other treatment*, morphine. *Result*, death. *Remarks*. Author says the use of the antitoxin certainly did not appear to produce any amelioration of the symptoms.

No. 82.—*Name*, McEwan,[154] *Year*, 1896. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, amputation of toe for injury. *Period of incubation*, ten days. *Day of first injection*, third day. *Method of administration*, subcutaneous. *Amount*, 100 cubic centimetres. *Make*, Paris Institute Pasteur. *Other treatment*, chloral. *Result*, death. *Remarks*. Author thinks both were severe cases; and says that, although the antitoxin was used early, it produced no amelioration of the symptoms.

No. 83.—*Name*, McEwan.[154] *Year*, 1896. *Diagnosis*, Tetanus puerperalis. *Nature of injury*, abortion. *Period of incubation*, seven days. *Day of first injection*, first day. *Method of administration*, subcutaneous. *Amount*, 2.0. *Make*, Duncan and Flockhart, also 10 cubic centimetres. *Make*, Paris Institute Pasteur. *Other treatment*, chloral. *Result*, death.

No. 84.—*Name*, Greenwood.[155] *Year*, 1896. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, gunshot wound of hand, compound fracture. *Period of incubation*, eleven days. *Day of first injection*, fourth day. *Method of administration*, subcutaneous. *Amount*, 162 grains. *Make*,

Tizzoni. *Other treatment,* various remedies. *Result,* recovery. *Remarks.* Author says a bad case, though he will not say that recovery was due to the antitoxin, he has seen improvement from its use.

No. 85.—*Name,* Williams.[156] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of radius and ulna. *Period of incubation,* four days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 60.0. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 86.—*Name,* Macartney.[157] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* removal of epithelioma of vulva. *Period of incubation,* eight days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* minimum dose. *Make,* British Institute of Preventive Medicine. *Other treatment,* not stated. *Result,* death. *Remarks.* (Did infection occur at the time of the operation?)

No. 87.—*Name,* Macartney.[157] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contused wound of ankle, caused by passage of a cart-wheel. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* three-fifths of adult dose. *Make,* not stated. *Other treatment,* chloral. *Result,* death. *Remarks.* Author says he has not seen the slightest effect from the antitoxin in either case.

No. 88.—*Name,* Macartney.[157] *Year,* 1896. *Diagnosis,* tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* three or four days. *Day of first injection,* soon. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 89.—*Name,* Bronner.[158] *Year,* 1896. *Diagnosis,* Tetanus(?). *Nature of injury,* not stated. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* not stated. *Other treatment,* chloral and KBr. *Result,* recovery.

No. 90.—*Name,* Tracey.[159] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* burn of forehead and leg. *Period of incubation,* fourteen days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 4⅛. *Make,* Tizzoni. *Other treatment,* chloral, morphine, atropine. *Result,* recovery. *Remarks.* (Judging from description, evidently a mild case.)

No. 91.—*Name,* Farrant.[160] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of palm; compound fracture of leg; amputation. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10 grains. *Make,* British Institute of Preventive Medicine, also 59 grains, Tizzoni. *Other treatment,* not stated. *Result,* death. *Remarks.* (As amputation of the leg was performed only two hours after the accident, the infection very likely occurred from the palm.)

No. 92.—*Name,* Bienwald.[161] *Year,* 1896. *Diagnosis,* Tetanus(?). *Nature of injury,* not stated. *Period of incubation,* not stated. *Day of first injection,* second day. *Method of administration,* intravenous.

Amount, 5.0. *Make,* Behring. *Other treatment,* morphine. *Result,* death.

No. 93.—*Name,* Kocher.[102] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contused wound of knee. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* not stated. *Amount,* not stated. *Make,* some English make. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Author says prognosis was good in the case, and does not believe that it was the antitoxin which saved the life.

No. 94.—*Name,* Trevelyan.[103] *Year,* 1896. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* injury to eyelids. *Period of incubation,* twelve days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 1 tube. *Make,* Roux. *Other treatment,* morphine. *Result,* death. *Remarks.* Author says there was no improvement seen in this case from the antitoxin; but he still thinks that the future treatment of tetanus lies in this direction.

No. 95.—*Name,* De Palma.[104] *Year,* 1896. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* extensive injuries of nose and face. *Period of incubation,* seven days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 12.5. *Make,* Tizzoni. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* According to author, a very bad case.

No. 96.—*Name,* Cercignani.[105] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of hand, cobweb used as hæmostatic. *Period of incubation,* four days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 80 cubic centimetres and 24.5. *Make,* Tizzoni. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* According to author, a very bad case; recovery due to the antitoxin.

No. 97.—*Name,* Baker.[106] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* traumatic ulcer over ankle. *Period of incubation,* unknown. *Day of first injection,* fifteenth day. *Method of administration,* subcutaneous. *Amount,* 12.5. *Make,* not stated. *Other treatment,* not stated. *Result,* recovery.

REFERENCES.

[1] Honl: Ergebnisse der allgemeinen Pathologie und pathologischen Anatomie, p. 771, 1896.

[2] Sormani: La Riforma Medica, No. 10, 1890.

[3] Carbone and Perrero: Centralb. f. Bact. und Parasitenkunde, Vol. xviii, No. 7, 1895.

[4] Kamen: Central. f. Bact. und Parasitenkunde, Band xviii, Nos. 17 and 18, 1895.

[5] Hochsinger: Centralb. f. Bact. und Parasitenkunde, Nos. 6 and 7, 1887.

[6] Dor: Semaine Médicale, No. 22, 1890.

[7] Brieger and Fränkel: Deutsche med. Wochenschrift, No. 13, 1887.

[8] Brieger: Deutsche med. Wochenschrift, 1887.

[9] Brieger and Cohn: Zeitschrift f. Hygiene, Vol. xv, p. 1.
[10] Courmont and Doyon: Le tétanos, 1899.
[11] Nicolaier: Virchow's Archiv, Vol. cxxviii, p. 1.
[12] Klemm: Berlin. klin. Wochenschrift, No. 3, 1893.
[13] Simpson: Edinburgh Monthly Journal of Medicine, 1854.
[14] Chantemesse and Widal: Le Bull. méd., No. 74, 1889.
[15] Heyse: Deutsche med. Wochenschrift, No. 14, 1893.
[16] Amon: Münchner med. Wochenschrift, No. 23, 1887.
[17] Beumer: Zeitschrift für Hygiene, Vol. iii, p. 242, 1887.
[18] Peiper: Centralblatt für klinische Medicin, No. 42, 1887.
[19] Goldscheider and Flatau: Fortschritte der Medicin, No. 6, p. 609, 1897.
[20] Goldscheider and Flatau: Fortschritte der Medicin, No. 6, p. 211, 1898.
[21] Matthes: Deutsche Zeitschrift für Nervenheilkunde, Vol. xiii, 1898.
[22] Westphal: Fortschritte der Medicin, No. 13, 1898.
[23] Goebel: Monatsschrift für Psychiatrie und Neurologie, Vol. iii, No. 1, 1898.
[24] Tauber: Wiener klinische Wochenschrift, No. 31, 1898.
[25] Nicolaier: Deutsche med. Wochenschrift, 1884.
[26] Stintzing: Mittheilungen aus den Grenzgebieten der Medicin und Chirurgie, Vol. iii, Nos. 3 and 4.
[27] Stintzing: Münchner med. Wochenschrift, No. 40, 1898.
[28] Brunner: Zeitschrift f. klinische Medicin, Vol. xxxi, p. 367.
[29] Brunner: Zeitschrift f. klinische Medicin, Vol. xxxii, p. 207.
[30] Brunner: Beiträge zur klinischen Chirurgie, Vol. ix, No. 1.
[31] Brunner: Deutsche med. Wochenschrift, No. 5, 1894.
[32] Gumprecht: Deutsche med. Wochenschrift, No. 26, 1894.
[33] Wassermann and Takaki: Berliner klin. Wochenschrift, Nos. 1 and 10, 1898.
[34] Moritz: Münchner med. Wochenschrift, No. 30, 1893.
[35] Henoch: Charité Annalen, Vol. xviii, p. 339, 1893.
[36] Engelmann: Münchner med. Wochenschrift, No. 32, 1897.
[37] Kallmeyer: Münchner med. Wochenschrift, No. 30, 1893.
[38] Tauber: Wiener klin. Wochenschrift, No. 31, 1898.
[39] Rotter: Deutsche med. Wochenschrift, No. 7, 1893.
[40] Rose: Deutsche Chirurgie, Lieferung 8.
[41] Garrigues: American Journal of Obstetrics, 1882.
[42] Gowers: "Manual of Diseases of the Nervous System," second edition.
[43] Dean: British Medical Journal, September 15, 1894.
[44] British Medical Journal, September 22, 1894.
[45] Medical News, July 22, 1899.
[46] Albertoni: Therapeutische Monatshefte, p. 437, 1892.
[47] Marson: Lancet, August 10, 1895.
[48] Hewlett: British Medical Journal, March 2, 1895.
[49] Kanthack: Medical Chronicle, p. 92, 1895.
[50] Wellner: Ergebnisse der allgemeinen Pathologie und pathologischen Anatomie, p. 310, 1896.
[51] Köhler: Münchner med. Wochenschrift, No. 45, 1898.
[52] Weischer: Münchner med. Wochenschrift, No. 46, 1897.

[83] Lambert: New York Medical Journal, June 5, 1897.
[84] Lund: Boston Medical and Surgical Journal, August 18, 1898.
[85] Holsti: Zeitschrift für klin. Medicin, Vol. xxxvii, Nos. 3 and 4.

REFERENCES TO CASES TREATED BY SUBCUTANEOUS OR INTRAVENOUS INJECTIONS.

[86] Schwartz: Centralblatt f. Bact. und Parasitenkunde, Vol. x, No. 24, 1891.
[87] Baginsky: Berlin. klin. Wochenschrift, No. 9, 1893.
[88] Finotti: Wiener klin. Wochenschrift, No. 1, 1892.
[89] Finotti: Wiener klin. Wochenschrift, p. 921, No. 50. 1892.
[90] Berger: Münchner med. Wochenschrift, p. 921, No. 50, 1892.
[91] Polaillon: Münchner med. Wochenschrift, p. 921, No. 50, 1892.
[92] Taruffi: Centralbl. f. Bakt. und Parasitenkunde, Vol. xi, No. 20, 1892.
[93] Casali: Centralbl. f. Bakt. und Parasitenkunde, Vol. xii, Nos. 2 and 3.
[94] Tizzoni: Gazzetta degli ospedal. e dell. clin., p. 819, No. 88, 1892.
[95] Renon: Annales de l'Inst. Pasteur, No. 4, p. 233, 1892.
[96] Pacini: Riforma medica, No. 4, 1892.
[97] Gagliardi: Riforma medica, No. 11, 1892.
[98] Finotti: Wiener klin. Wochenschrift, No. 7, 1893.
[99] Lesi: Centralbl. f. Bakt. und Parasitenkunde, p. 393, 1893.
[100] Henoch: Charité Annalen, Vol. xviii, 1893, p. 339.
[101] Moritz: Münchner med. Wochenschrift, No. 30, 1893.
[102] Von Ranke: Münchner med. Wochenschrift, p. 571, No. 30, 1893.
[103] Von Ziemssen: Münchner med. Wochenschrift, p. 573, No. 30, 1893.
[104] Brunner: Münchner med. Wochenschrift, p. 573, No. 30, 1893.
[105] Baginsky: Berlin. klin. Wochenschrift, No. 9, 1893.
[106] Escherich: Wiener klin. Wochenschrift, No. 32, 1893.
[107] Gattai: Centralb. für Bakt. und Parasitenkunde, Vol. xiv, Nos. 4 and 5.
[108] Magagni: La Riforma Medica, No. 28, 1893.
[109] Buschke and Oergel: Deutsche med. Wochenschrift, No. 7, 1893.
[110] Rotter: Deutsche med. Wochenschrift, No. 7, 1893.
[111] Barth: Semaine Médicale, Vol. xiii, No. 14, 1893.
[112] Roux and Vaillard: Annal. del'Inst. Pasteur, p. 123, No. 2, 1893.
[113] Berger: Bull. de l'Academie Médecine, Paris, No. 21, 1893.
[114] Dean: British Medical Journal, September 15, 1894.
[115] Evans: British Medical Journal, September 15, 1894.
[116] Fanning: British Medical Journal, September 29, 1894.
[117] Parker: British Medical Journal, November 24, 1894.
[118] Clarke: Lancet: January 27, 1894.
[119] Paget: Lancet, February 24, 1894.
[120] Giusti and Bonaiuti: Berlin. klin. Wochenschrift, No. 36, 1894.
[121] Bauer: Wiener klin. Wochenschrift, No. 45, 1894.
[122] Doerfler: Münchner med. Wochenschrift, p. 282, 1894.
[123] E. Schwartz: Wiener med. Wochenschrift, No. 49, 1894.
[124] Tavel: Korrespondenzbl. f. schweizer Aerzte, p. 106, 1894.
[125] Remesoff and Fedoroff: Centralbl. f. Bakt. und Parasitenkunde, Vol. xv, p. 115, 1894.

[125] Von Hacker: Wiener klin. Wochenschrift, No. 25, 1894.
[126] Marson: Lancet, August 10, 1895.
[127] Marriott: British Medical Journal, January 19, 1895.
[128] Fenwick: British Medical Journal, February 23, 1895.
[129] Williamson: British Medical Journal, February 23, 1895.
[130] Gornall: British Medical Journal, April 27, 1895.
[131] Turner and Cheatle: Lancet, December 7, 1895.
[132] Farrant: Lancet, December 7, 1895.
[133] Tirard: Lancet, November 2, 1895.
[134] Hartley: Lancet, December 7, 1895.
[135] Oelberg: Wiener klin. Wochenschrift, No. 49, 1895.
[136] Firth: British Medical Journal, January 19, 1895.
[137] Pel: Centralb. f. innere Medicin, p. 713, No. 29, 1895.
[138] Granowsky: St. Petersburg med. Wochenschrift, p. (27), 1895.
[139] Thompson: New York Medical Record, January 5, 1895.
[140] Miti: Gazzetta degli ospedal. e dell. clin., p. 22, No. 3, 1895.
[141] Illuminati: Gazzetta degli ospedal. e dell. clin., p. 629, No. 60, 1895.
[142] Douglas: British Medical Journal, October 27, 1894.
[143] Caretti: La Riforma medica, No. 14, 1895.
[144] Walko: Deutsche med. Wochenschrift, No. 36, 1895.
[145] Vagedes: Zeitsch. f. Hygiene und Infect., Band xx, p. 295, 1895.
[146] Preindlsberger: Mittheilungen aus der chirurgischen Abtheil. des bosnish-herzogovinischen Landesspitales, July 1, 1894—December 31, 1896.
[147] Howlett: Medical Chronicle, Vol. iv, p. 186, 1895.
[148] Foges: Wiener med. Wochenschrift, Nos. 24 and 25, 1895.
[149] Willemer: Deutsche med. Wochenschrift, No. 46, 1896.
[150] Ridge: British Medical Journal, September 12, 1896.
[151] Fenwick: British Medical Journal, September 12, 1896.
[152] Baker: British Medical Journal, December 26, 1896.
[153] Baker: British Medical Journal, January 25, 1896.
[154] McEwan: Lancet, August 8, 1896.
[155] Greenwood: Lancet, October 10, 1896.
[156] Williams: Lancet, December 5, 1896.
[157] Macartney: Lancet, January 18, 1896.
[158] Bronner: Lancet, April 25, 1896.
[159] Tracey: Lancet, February 1, 1896.
[160] Farrant: Lancet, March 28, 1896.
[161] Bienwald: Deutsche med. Wochenschrift, No. 49, 1896.
[162] Kocher: Korrespondenzbl. f. schweizer Aerzte, p. 87, 1896.
[163] Trevelyan: British Medical Journal, February 8, 1896.
[164] De Palma: Gazzetta degli ospedal. e dell. clin., p. 750, No. 71, 189.
[165] Cercignani: La Riforma Medica p. 26, No. 228, 1896.
[166] Baker: British Medical Journal, November 28, 1896.

(TO BE CONTINUED.)

MALIGNANT DISEASES OF THE STOMACH AND PYLORUS.[1]

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CARCINOMA of the stomach causes about 1 per cent. of the total death-rate (Van Valzah) and is the most common form of malignant disease. Welch, in an analysis of 30,000 cases of malignant neoplasms, gives the percentage as 21.4, the statistics of Virchow at 35 per cent., and Haberlin 41.5.

Age has a more important bearing on carcinoma of the stomach than on the same disease in the lower portion of the gastro-intestinal tract. In the former locality it is peculiarly a disease of middle and later life; under thirty it is most rare, although Moore reports a case at the age of thirteen. It is slightly more frequent in males than in females (five to four, Welch), the disproportion, however, is not so great as the older authorities were inclined to believe.

The progress of the disease varies greatly, and is materially affected by the age of the patient, the situation of the growth, and its histological structure. Death may follow in three months from the first symptoms, or it may be delayed to two and one-half years,—the majority die within the year. Park is of the opinion that all forms of malignant tumors are on the increase; how much of this increase is apparent rather than real, and due to better methods of diagnosis, is open to discussion.

Surgery offers the only hope of cure; it is important that carcinoma of the stomach be considered a surgical disease, and a suspicion of gastric cancer should cause the physician to send the patient to the surgeon for exploratory incision to

[1] Read before the American Surgical Association, May 2, 1900.

complete the examination. The same principles should govern here as in probable malignant disease of the breast or uterus. The great difficulty which arises in carrying this proposition into effect is the question of early diagnosis. In a general way it can be said that the early medical diagnosis of cancer of the stomach does not depend on any one specific sign or symptom, but rather on a collection of facts, each one of which, if taken alone, would have but little value; and, again, most of these symptoms are not developed to a characteristic extent until late. Osler relates a number of cases of latent cancer of the stomach in which there were no symptoms during life to lead to suspicion of malignant disease, the true condition being found at post-mortem.

A person of middle or advanced life of previous good digestive power begins to complain of pain in the region of the stomach, difficult digestion, and loss of appetite. There is a continuous loss of flesh, especially the muscles; a progressive waste of the albuminous tissues; later, there is more or less vomiting depending on the situation of the growth, perhaps of blood partially digested and likened to coffee-grounds. A tumor may gradually become discernible (115 out of 150 cases, Osler). A dry cachexia develops, and transitory œdemas, most commonly affecting the lower limbs and due to a local phlebitis, may occur. This seems a clear clinical picture of malignant disease, but the fault is that, surgically speaking, the case has been hopeless after the first few weeks. Czerny, Kraske, and many other eminent surgical authoritites believe that radical operation is out of the question by the time a tumor can be felt.

Examination by means of stomach tests adds to our diagnostic resource. The absence of free hydrochloric acid is an indication of value, and occurs in 60 per cent. of all cases; but it is not always well marked early, and in the forms of malignant disease developing upon ulcer, of which a number has been collected and described by Hemmeter, the free hydrochloric acid may even be increased. Another valuable indication is the presence of lactic acid accompanied by the Oppler-

Boas bacillus. Reduced motor power of the stomach independent of obstruction is a constant symptom, but is also common to non-malignant disease, such as gastric myasthenia. Terrier in his recent work on surgery of the stomach says that "the examination of a fasting stomach gives the largest amount of information." The only positive diagnostic indication is the finding of cancer elements in the fragments washed out of the stomach; here again, unfortunately, the spontaneous detachment of such specimens in an early stage of the disease must necessarily be a very rare occurrence. The value, however, is absolute, and efforts in this direction are increasing. In the laboratory of Boas, the first systematic efforts to detach pieces of the growth for this purpose were made.

To also locate the point from which the pieces are detached, Kuhn invented a spiral sound which could be watched with the X-ray. Hemmeter has systematically developed this method of examination to a great extent both in the means of detaching the fragments and in the certainty as to the location of their origin, the examination being conducted after the manner of uterine scrapings. The latter authority calls especial attention to the diagnostic importance of atypical as well as pathological mytoses of the cells. One important point remains to be determined. Is there danger of increasing the spread of the disease by diagnostic curetting?

The removal of pieces of malignant growth for microscopical examination is a doubtful practice. Senn warns against the rough handling of a malignant tumor for the purpose of making a diagnosis, and says that such "diagnostic massage" may result in increased activity.

Halsted opposes the removal of portions of a malignant growth for diagnostic purposes on account of the danger of inoculation. Whether this objection would hold good in the necessary manipulations for the removal of fragments from a gastric cancer is worthy of consideration. Examination of the blood shows reduced specific gravity, diminished hæmoglobin, and number of the red corpuscles and reduction in

their size; these changes are due to the anæmia, and have no special characteristic in malignant disease of the stomach. The white corpuscles are often increased by the accompanying inflammation and ulceration. The urinary changes are in no way peculiar to the cancerous process. The indican, so frequent an accompaniment, is the result of the retention, and the other changes to the albuminous waste and low state of the nutrition.

Van Valzah says that careful and repeated examination of a suspicious case of carcinoma of the stomach should develop a probable diagnosis in two or three weeks.

The scientific zeal with which the diagnosis is sought has in itself a distinct danger. The suspicious case is often kept under observation too long in the hope of making a positive diagnosis. The surgeon should not ask the physician for a diagnosis of gastric cancer; if we wait for that, we are pretty sure of being too late. It is the suspicious cases which should be explored, and it is the duty of the physician to urge this when in doubt.

A few indications with the history should suffice, and the matter laid before the patient to decide as to an exploration. There is no reason why the radical cure of cancer of the stomach should not approach that of the uterus or breast. It is true the difficulties of diagnosis are increased, yet the early symptoms are as positive. The tumor in the breast at an early stage is unnoticed, or no attention paid to it, and the early history of cancer of the uterus is notoriously defective. The result is, that the number of cures in either breast or uterine cancers is not large. The majority have passed the curable stage before the diagnosis is made. This has been and will be true of the stomach, but the results should be much better than they are.

Section 2.—The curability of cancer of the stomach depends upon the (*a*) Histological structure of the neoplasm. (*b*) Its location. (*c*) Extension to neighboring structures. (*d*) Lymphatic infection. (*e*) The general condition of the patient. It is essential that the relative value of the mani-

festation of the malignant process be studied, for upon a correct appreciation of the conditions present depends the whole question of treatment.

(*a*) Every cancer is at one time a local process, and in that stage curable, but the duration of this stage is usually short. The rapidity of progress of carcinoma of the stomach is largely influenced by the relation of the cells to the stroma. If the cellular elements predominate the growth is soft and its extension rapid. If the stroma is in excess of the parenchyma, the tumor mass is harder and slower of growth. Hemmeter classifies the malignant epithelial tumors of the stomach into (1) Adenocarcinoma, (2) Cylindrical carcinoma, (3) Medullary carcinoma. The common degenerations being colloid and scirrhus. The colloid type is usually an unfavorable indication, and if it exists to any extent indicates a late stage of the disease beyond radical intervention. Secondary nodules, the result of a primary gastric cancer, are especially prone to this form of softening, and may obscure the original focus. In the metastatic deposits in the omentum, colloid degeneration may develop a tumor of very large size. Sutton describes one weighing ten pounds. Scirrhus refers to the relatively large proportion of connective tissue stroma which is undergoing more or less contraction, and indicates a slower process. This variety is the most common form of stomach carcinoma (72 per cent., Brinton).

Pyloric growths are usually scirrhus, and often follow the lines of the blood-vessels encircling the pyloric end of the stomach, producing an early obstruction and may cause death, while still an operable growth. In some cases the contraction may not take place, leaving the pylorus open and gaping. More rarely, diffuse infiltrating carcinoma of the whole stomach wall may exist either as a primary or secondary process. This disease is more common than cirrhosis of the stomach (Bristowe's water-bottle stomach) and often mistaken for it. Hektoen, in describing two cases of the primary form, calls attention to the necessity of careful search for the carcinoma

cells to prevent misconception as to the nature of the disease.

The cylindrical cell carcinoma is the most favorable form of disease for extirpation. It is slower of growth, and does not develop adhesions to neighboring organs in the early stages.

(*b*) The location of the growth is important, an early diagnosis depending to some extent on the mechanical features present, and the accessibility to operative procedures is very largely determined by the situation. Approximately, 10 per cent. involve the cardiac area, 30 per cent. the body, and 60 per cent. the pyloric end of the stomach (Gussenbauer).

The cardiac orifice is seldom the primary seat of disease, but rather an extension upward from the fundus or downward from the œsophagus. The symptoms are painful deglutition, and later obstructive regurgitation. The clinical diagnosis is comparatively easy, but the situation renders radical operation exceedingly difficult and usually impossible. The progress of malignant disease of the cardia is rapid; it involves neighboring structures early, and death follows active symptoms within a few months. Carcinoma of the body is most difficult of early diagnosis, as a rule presenting few symptoms until it is well advanced, unless by extension it involves one of the orifices, and thereby introduces mechanical phenomena. Einhorn thinks the gastro-diaphranoscope is useful in outlining a tumor of the body. The X-ray has been used for the same purpose, the utility of either is doubtful. Kocher says that under deep anæsthesia a tumor can sometimes be mapped out early. It is fortunate that the pylorus is so often affected; the mechanical obstruction favors an early diagnosis, and, as shown by Winniwater more than twenty years ago, many cases die from starvation produced by a surgically curable growth. Israel states that the pylorus itself is not so often the primary seat of disease as has been thought; the infiltration from any place in the pyloric end of the stomach naturally extends in this direction and is arrested at that point.

In the earlier stages the process cuts off rather sharply at the duodenum. The situation is most favorable for extirpation. Obstruction with resulting dilatation of the stomach has usually been the most important factor in determining operation in the cases submitted to extirpation. Kocher states that, if food is regularly found in the stomach fourteen hours after taking, mechanical obstruction exists. Myasthenia with retention and hyperasthenic gastritis with retention give this symptom, and are not necessarily due to a mechanical obstruction, although valve formation often coexists. In these cases chronic dilatation is found, and often hyperchlorhydria or supersecretion. While the differential diagnosis is not difficult, surgery offers the best means of cure in all forms of chronic dilatation of the stomach. The finding of a dilated stomach brings the case within surgical limits, and if chronic retention exists, other things being equal, operative relief is indicated. The amount of dilatation due to pyloric cancer depends to some extent upon the situation of the pylorus; if held high by a short gastrohepatic omentum, the stomach is emptied by muscular contraction; in malignant disease compensatory hypertrophy is deficient, and dilatation comes on rapidly. If the pylorus lies low down, gravity aids the onward course of the ingesta, and a larger amount of obstruction is well borne.

(*c*) Direct extension to surrounding structures. Along the paths formed by adhesions the malignant infiltration takes place. In most instances this is a late phenomenon, and acts as a contraindication to operation, but not necessarily so if the case is otherwise favorable. The adhesions may be recent, and due to a septic process rather than the malignant disease. Advance adhesive inflammation takes place in the vicinity of ulceration, and, later, fistulæ may form between the stomach and duodenum or colon, or rarely with the abdominal coverings. Perforation occurs in about 6 per cent. of the cases, causing death at once if in the free peritoneal cavity, or subphrenic abscess if protective adhesions exist.

Indirect extension through the blood-vessels is, rarely,

the cause of metastatic deposits. The arteries are very resistant, but the veins are more easily invaded, and from the infected thrombus emboli are carried to the liver, lungs, etc. Peritoneal inoculation is a rare sequela of cancer of the stomach. The most common method of advance is by extension to adjacent structures, and this is true of recurrences after extirpation, which are usually local.

From an operative stand-point adhesions are a serious complication, and, as they are usually infiltrated with carcinomatous cells, the extirpation under such circumstances will be unpromising. Haberkant's statistics of extirpation show that where adhesions were extensive 72 per cent. died. If no adhesions existed, only 27 per cent. died. Gussenbauer, in 542 cases of cancer of the pylorus, found that in 37 per cent. there were no adhesions, in 41 per cent. there was no metastasis to other organs.

(*d*) Lymphatic infection is a still more serious complication, because if palpable glandular malignancy can be established, it is altogether probable that the involvement has passed beyond reach. Enlargement of glands without microscopical proof cannot be considered necessarily malignant. In twenty-nine cases of non-malignant disease of the stomach which I have operated on for the relief of dilatation from benign causes, in more than half enlarged glands could be palpated.

Fenger, in his study of the effects of stone in the common duct of the liver, noted the fact that enlarged glands could sometimes be felt about the head of the pancreas, leading to the belief that malignant disease existed. Halsted found such non-malignant glandular enlargement occasionally in malignant disease of the breast. It has been frequently noted in the submaxillary glands during the course of lip carcinoma, and in malignant disease accompanied by inflammatory lesions it is to be expected. In due time these glands undoubtedly become malignant, just as inflammatory adhesions are later infiltrated. In my experience, the septic glands are smaller and softer than the carcinomatous. Mikulicz says the lymphatic glands tributary to the stomach lie in four groups:

First, along the lesser curvature and cardia; second, along the greater curvature; third, in the gastrocolic omentum; fourth, about the head of the pancreas. The modern operation for the removal of the glands with carcinoma of the breast suggests a similar glandular extirpation in radical operation on the stomach. Linder does not believe this feasible. In twenty-eight recurrences after extirpation fifteen were local, twelve distant, and only one involved the glands. Sutton says that glandular involvements are only found in about one-half of the cases dying with gastric cancer. It is probable that this is too low an estimate, and that at least 65 per cent. dying of cancer of the stomach have well marked glandular involvement. In the earlier stages, however, the percentage is smaller. The usual route of travel is to the deep glands, liver, etc.

Binnie, discussing carcinoma of the umbilicus secondary to cancer of the stomach, says that such unusual routes of travel are indications of inflammatory or mechanical impediments in the normal channels. He believes the infrequent recurrence in the glands after extirpation of stomach cancer is due to the destruction of the normal lymphatics at the time of operation.

Russell has recently pointed out that the cure of cancer of the uterus depended upon wider local extirpation rather than removal of the glands, and this statement is equally true of the stomach. An investigation leads to the belief that glandular infection in cancer of the stomach is not uniform, many cases die without such infection, and that a moderate enlargement may be septic. Should they become infected, their situation renders radical removal practically impossible.

(*e*) The condition of the patient is a factor of importance. Malignant disease of the stomach has a peculiar depressing effect. The nutrition is bad and the healing power is greatly impaired. Under equal conditions, a most formidable operation for malignant disease about the head or neck would be well borne. A degree of cachexia out of proportion to the demonstrable disease is of bad omen, unless the debility can

be shown to be due to a mechanical condition, such as obstruction. Ascites even in a limited degree contraindicates a plastic operation, such as gastro-enterostomy, and renders any kind of an operative procedure hazardous, as firm adhesions do not take place.

Sarcoma of the stomach is a rare disease; in 1899, Van Valzah and Nesbit found forty-three cases recorded. It is more common in males and under thirty-five years of age. Finlayson recently reported a case in a child three years of age. The disease may present itself as a smooth, rounded tumor, and by its weight may cause considerable prolapse of the stomach. In some of the cases reported the tumor had a limited origin in the stomach wall and was easily extirpated. Rarely it occurs as a diffuse sarcomatous infiltration. Sarcoma seldom contracts, and involvement of the orifices does not produce the mechanical interference with the progress of the food so marked a symptom of scirrhus; incontinence is the rule. It is more often a secondary involvement of the stomach than carcinoma. The diagnosis in the cases operated upon has seldom been made, the operation being usually commenced under a misapprehension as to the nature of the growth. In the majority of instances there were no marked gastric symptoms to suggest that an abdominal tumor present had its origin in the stomach. In a few cases ulceration and hæmorrhage have been a late symptom. Baldy, in 1893, removed almost the whole of the stomach for sarcoma without success. A number of partial gastrectomies have been recorded with successful outcome. In several of the cases the tumors removed were of considerable size.

Section 3.—The exploratory incision for suspected cancer of the stomach, instead of being a last resource, should be one of the first, and promptly undertaken if the condition cannot be proved to be non-malignant. A median incision between the ensiform cartilage and the umbilicus is most useful for stomach exploration. A small opening readily exposes the pyloric portion, which is the most common seat of disease. The writer at times has experienced considerable difficulty,

after opening the abdomen, in ascertaining the real condition. What are the local appearances which enable us by palpation and inspection to say that a certain thickening of the stomach wall is malignant? There are no definite signs which occur in all cases, and much depends upon the experience of the surgeon. It is hardly practicable to remove a portion of the growth and have a microscopical examination made before finishing the operation, nor is such practice devoid of danger of inoculation. In all of the cases I have explored the growth was hard and had an appearance of increased vascularity, and the general "feel" of the diseased part was distinctly malignant. At times, with the diseased part thoroughly explored and in some cases laid open by incision, it is impossible to state from macroscopical examination whether it is benign or malignant.

Czerny's experience is very interesting; four cases in which gastro-enterostomy was done for supposed malignancy lived so long as to preclude the possibility of cancerous disease.

Exploration of the neighborhood of the cardiac orifice is difficult and often unsatisfactory. A small opening may be made into the stomach cavity, and with a finger introduced through the incision the anterior wall can be invaginated to enable the exploring digit to search the opening into the œsophagus. Should the orifice be tightly closed, pressure for a little time may be necessary before a dimple can be felt at the normal opening (Abbe). For instrumental examination of the cardiac orifice, a small incision should be made in the anterior wall and the lesser curvature held taut, this forms a sulcus leading directly to the opening (Richardson).

The body of the stomach anteriorly can be readily examined, by traction a considerable portion can be drawn forth for inspection. By an incision through the gastrocolic omentum a portion of the posterior wall can be inspected. The pylorus is fortunately easily explored, and, unless adhesions have formed, it can be brought fully out of the abdominal cavity. If it is held within the cavity of the abdomen and under the liver,

by a short gastrohepatic omentum this latter structure can be partly divided without injury to the nerve or blood supply, readily mobilizing the pylorus and upper portion of the duodenum. The author has in five instances been unable to make an exact diagnosis even after exploratory incision. In two, the pylorus was held high up and under the liver by adhesions, the symptoms being obstructive. If the disease was cancerous, the position and the extension to surrounding structures by adhesions would prevent radical operation. In each, a gastro-enterostomy was performed for relief of the mechanical condition present. In one, there could be felt a hard mass on the posterior wall, with signs of extensive inflammation in the lesser cavity of the peritoneum. There had evidently been a perforation; but, even with an incision in the anterior wall of the stomach, I was unable to tell whether it was malignant or not. Here, again, gastro-enterostomy was performed on the theory that if the perforation was due to simple ulcer, recovery would be hastened; and if carcinomatous, some relief would be experienced. In the fourth case a small stomach was found deep under the liver; with a finger inside the stomach cavity, I could not reach the cardiac orifice. The clinical evidence leads to the belief that the obstruction was malignant, and gastrostomy was decided upon without further attempt at diagnosis. In the fifth case the evidences of malignant obstruction at the cardiac opening were marked; the condition of the patient was such that gastrostomy was done as quickly as possible, without any attempt to freely explore as to the nature of the obstructive lesion. In twelve cases malignant disease was quickly shown too far advanced to extirpate, and, not presenting symptoms, such as obstruction, requiring palliation, nothing being left to do further than to rapidly close the abdominal incision. In one of my earlier explorations in which extensive malignant disease was found without symptoms requiring palliation, the incision was closed, and the patient put to bed to wait the usual length of time for healing to take place, the debility increased, and, while he lived several weeks, he was unable to return to his home before death.

Since that time I have closed the incision under such circumstances with permanent silver-wire sutures after the Halsted plan, and get them up on the third day, and let them leave the hospital in a week.

Silver wire buried in fixed aponeurotic structures, in my experience, does not give rise to the atrophy necrosis sometimes seen when placed in muscles. The hernia liability, in any event, is of no great consequence to the victim of an incurable malady. It may be justly said that exploration on cases of advanced malignant disease of this description is not good practice; yet there will always be a certain number of cases in which the diagnosis will be uncertain, although advanced disease exists. The extent to which the exploration will be carried will vary with different operators. Personally, I have not made undue effort to perfect the diagnosis if extirpation did not seem proper, and have been contented with giving such relief as the circumstances would permit.

Section 4.—Complete removal of the stomach has won a foothold, but to what extent the future only can determine. The more radical believe that even if the disease has affected only a limited and apparently excisable portion of the stomach, the whole organ should be removed, that pylorectomy and partial gastrectomy are not based on correct principles, and the large percentage of local recurrences after partial operations certainly give color to this view. Bernays calls attention to the improvement in the results of cancer of the uterus since complete hysterectomy has replaced amputation of the cervix, and believes that this will be true of the stomach. On the other hand, the number of successful complete gastrectomies are so few and of such short duration that the problem cannot be solved at this time. It is, however, altogether probable that complete gastrectomy is destined to become a most valuable operation. In cancer of the body nothing else in the way of radical operation offers a reasonable prospect of cure, and all the forms of pyloric cancer with a tendency to infiltrate the body of the stomach can be placed in the same category, reserving pylorectomy and partial gastrectomy for the not un-

common cases of ringlike infiltration. These later cases kill by obstruction, and there can be no more reason for a complete gastrectomy in such cases than in removal of the whole of the large bowel for a cancerous stricture of the colon. It is in these cases that the partial operation has achieved its triumph.

It is to the credit of American surgery that the first complete removal of the stomach was performed by Conners, an operation condemned at the time by reason of its unfortunate termination. It was Schlatter's success, not his originality, which called attention to the possibilities of gastrectomy, and the cases of Richardson, Brigham, McDonald, and others quickly gave it a standing, and more than fifteen operations have now been performed. The ease with which the duodenum has been approximated to the œsophagus in many of the reported cases is surprising; it certainly is an important factor in the result. The duodenum, on account of its diameter and function, certainly offers the best prospect of replacing the stomach, and it is yet to be determined whether an opening between the œsophagus and jejunum would serve equally as well. The case of Schlatter's was of this description, and the result was, functionally, as satisfactory as the œsophagoduodenostomy. In the determination of the advisability of gastrectomy, the ability to approximate the duodenum to the œsophagus is of importance. Richardson calls attention to the fact that a permanent duodenostomy might be made should it be impossible to make a competent anastomosis. A number of the deaths after partial as well as complete gastrectomy have been caused by including a portion of the mesocolon in the ligatures used to free the greater curvature of the stomach, with resulting gangrene of the transverse colon. If the gastrohepatic omentum is tied off first, the fingers can be slipped underneath the pylorus and act as a safe guide to the ligation and division of the gastrocolic omentum.

As to the form of union, the Murphy button and the simple suture plan have both been used. Opinion is divided as to which is of the greater merit. As elsewhere in the gastro-

intestinal tract, the results seem to be about the same,—the one used depending more on the individual preference of the operator than any special indication. Mayo Robson, in the Hunterian Lectures for 1900, gives statistics showing a death-rate of 50 per cent.; the cases are yet too few from which to draw any accurate conclusions.

Pylorectomy and Partial Gastrectomy.—Operations limited to the pyloric end of the stomach and its immediate vicinity have been largely practised for malignant disease, and the results, taken as a whole, have not been satisfactory. A few cures have taken place in exceptionally favorable cases, mainly the malignant strictures, where the mechanical effects lead to an early diagnosis and operation. Limited extirpations to be successful must go wide of the disease on the stomach side, and the rule is return at an early date. This is particularly true if the infiltration extends laterally along the stomach wall, and less so if the line of invasion follows the blood-vessels in a circular manner. The difficulties of diagnosis have rendered late operations the rule, and the absolutely unfavorable prognosis has encouraged operation in many cases unfit for so serious a procedure. The results both immediate and remote have been correspondingly bad. An occasional case, apparently with a hopeless extent of disease, gets well after extirpation and stays well; this leads the surgeon to an effort in similar cases with very disappointing results.

An analysis of the more recent cases of Kocher and Maydl show a decreasing immediate mortality, and a more encouraging percentage of permanent cures depending on an earlier diagnosis, and a better selection of cases. Maydl lost only 16 per cent., and in 28 per cent. there was early recurrence; the remaining 50 per cent. were still alive at the time of his report. Mayo Robson says that the evidence shows that operation can be reasonably expected to cure one case in three or four. Two years ago, within a period of six months the writer successfully performed pylorectomy and partial gastrectomy in three cases; up to that time no case had been explored sufficiently early to permit of radical operation, and I

regret to say that, although encouraged by these cases to greater efforts, in all the cases explored since that time nothing further than palliative operation has been indicated, on account of the advanced progress of the disease. The Kocher operation for pylorectomy and partial gastrectomy has been adopted by surgeons generally, and, while modified in some particulars by various surgeons, can be considered the best plan of procedure. It avoids the fatal suture angle of the Billroth method by completely closing the stomach end and forming an independent anastomosis between the duodenum and the remaining portion of the stomach. In a comparison of these two methods, Guinard shows a mortality in 148 cases by the Billroth method amounting to 38 per cent., and in sixty-four cases by the Kocher method only 16 per cent. of deaths.

In my cases I found the following plan satisfactory. First tie and divide the necessary amount of the gastrohepatic omentum; this mobilizes the pylorus and lesser curvature, and permits it to be easily delivered. The fingers are now passed behind the pylorus, from above, into the lesser cavity of the peritoneum; this renders ligation of the gastrocolic omentum free from the danger of injury to the vessels in the transverse mesocolon. The stomach should then be clamped above the disease, and with a knife a circular cut should be made completely around the healthy stomach to the mucous coat; the peritoneal and muscular coats are stripped back a half-inch, and the few bleeding vessels are caught with forceps and tied; the mucous coat is cut inch by inch from above downward, and sutured with a continuous catgut suture as cut, preventing leakage. After complete separation, the tumor is covered and turned to the right out of the way. The muscular coat is then sutured with a continuous catgut suture; finally, the peritoneum is turned in by a good silk Cushing stitch. The stomach is now sutured to the pedicles of the tied omenta anchoring it to the right, furnishing further protection against leakage, and also preventing undue traction on the duodenum, which, after safe amputation beyond the disease, is fastened

to the anterior wall of the stomach by a Murphy button. The operation is with some slight modification the Kocher method. Kocher uses the posterior anastomosis with suture. Czerny has used both the anterior and posterior method with suture and with the button. He thinks it makes little difference in the result. Greig Smith well says that any extirpation requiring over one hour for its performance is open to serious objection.

Czerny speaks favorably of Tupolskes's method of doing the operation in two stages where the patient is much debilitated. First the gastro-enterostomy to be followed in three weeks by pylorectomy. The interval enables the patient to recuperate his strength; he has practised this in one case. Kummel has also advocated this in starvation cases. Czerny says that one objection can be made,—the adhesions following the gastro-enterostomy interfere with the extirpation. It is a question whether the average patient, after experiencing the relief afforded by successful gastro-enterostomy, would submit to a second operation, and especially to one which promises so little as to permanent cure. Kocher has made the extirpation by his present method thirty times with five deaths. Malthe, in the Christiana clinic, had only one death in eleven cases. Kocher, out of a total of fifty-seven extirpations, had eleven alive, and five of these of such length of time as to be called cured.

The immediate mortality of pylorectomy varies from 25 to 55 per cent. In properly selected cases it should have as low or a lower death-rate than gastro-enterostomy. Pylorectomy requires the patient to be in good condition, and the growth must be in the early stage; gastro-enterostomy for malignant disease has no such limitations.

Levy has described an operation for the resection of the cardiac end of the stomach, but I am unable to find that it has been performed upon the living subject. Chlumsky says that any death within thirty days should be classed as operative mortality, and I believe this conclusion a just one.

The *palliative operations* depend on the situation of the

growth, and are based on mechanical conditions. Malignant obstruction of the cardiac orifice demands gastrostomy, and best at an early date, without waiting for marked starvation symptoms.

Relief from the irritation of the passing food markedly delays the progress of the disease, comparing in this respect with colostomy for the relief of cancer of the rectum. The original operations were undertaken with the one view of feeding the patient, the Fenger operation being the type. The author did his first gastrostomy after this plan, and the distress from the leakage almost equalled the benefit. In many cases the irritation from the leakage and enlargement of the fistula from ulceration constituted so distressing an after result that efforts were made to obviate this, and attempts to form a muscular sphincter about the opening were more or less successfully adopted.

The von Hacker operation using the left rectus muscle fibres for this purpose is the best of the kind. But not until Witzel published his method of lateral folding of the stomach wall about a rubber tube, forming an oblique channel and valvular opening, was the problem solved. The author has made four gastrostomies by this method, and the result in each instance was most gratifying. The Kader operation, which Curtis says was first described by Stam, is an adaptation of the Witzel method; the only difference being that the tube is introduced directly into the stomach cavity, and the walls brought up about it by a circular purse-string suture, Stam, or by lateral interrupted sutures, Kader. The object is to cause a cone or nipple-like projection to present into the gastric cavity. In the one case the writer used this method, the result was equally as good as in the Witzel plan. It is of special advantage in some cases on account of the ease with which a gastrostomy can be quickly done on a very small stomach.

The Marwedel operation is also a modification of the Witzel, the rubber tube being obliquely buried in the wall of the stomach itself. It is highly commended by Dennis, and

undoubtedly is as perfect as the method of either Witzel or Kader. The Ssbanajew-Frank method of gastrostomy is on an entirely different principle, and has great advantage in not requiring a tube. The fistula formed is a mucocutaneous one, and therefore permanent, while by the peculiar displacing upward of the cone of the stomach brought out of the deeper layers of the abdominal wall, a spout-like opening is maintained which is self-closing and does not leak. The only disadvantage is the difficulty of making the operation on a contracted stomach. McCosh gives the mortality of gastrostomy for malignant disease at 30 per cent.

The palliative treatment of advanced cancer of the body of the stomach is unsatisfactory; fortunately, mechanical conditions arising from this form of disease are unfrequent. Occasionally on exploration an inoperable growth of this kind is found, and the question is, Can we prolong life or induce future comfort? If sufficient healthy stomach remains on the cardiac side to permit of gastro-enterostomy, this should be done. The curetting of such growths through a gastrotomy wound advocated by Bernays has little to commend it, nor can the actual cautery so useful in advanced cancer of the uterus be used to any great advantage. Should the growth involve the orifices of the stomach, starvation may necessitate duodenostomy or jejunostomy for feeding purposes. Edward Martin reports a case relieved by duodenostomy made in a similar manner to the gastrostomy of Witzel.

Jejunostomy has had some degree of prominence, and at one time was a rival of gastro-enterostomy. Maydl performed twenty-five jejunostomies with four deaths, and strongly urges the operation in selected cases. Heidenhain reports several very satisfactory results from the operation, and believes that in cases in which the gastro-intestinal fistula must be made at a point within the possible future progress of the disease that jejunostomy is indicated rather than gastro-enterostomy.

Obstructions at the pyloric opening are most common, and the gastric retention which results demands relief. Gastro-enterostomy is the most generally useful operation per-

formed on the stomach; in suitable cases prolonging life, relieving pain, and promoting comfort.

It would be an unprofitable undertaking to go into the various methods of making the anastomosis, the literature of the subject is enormous. Two methods of performing gastro-enterostomy have stood the test of time,—the simple suture operation and the Murphy button. At the present stage of development the results are about the same, depending more on the experience of the operator than the method employed. In performing the operation by either method, it is important that the jejunum should be grasped at its origin and a coil formed about fourteen to sixteen inches in length. At this point the mesentery is also of sufficient length to prevent traction.

Care should be taken to have the direction of the peristalsis the same in the stomach and intestine when the anastomosis is effected. There has been considerable discussion as to whether the fistula should be established on the anterior (Wölfler) or posterior wall (Von Hacker) of the stomach. The latter necessitates an artificial opening into the lesser cavity of the peritoneum to get to the desired part of the posterior wall, and requires a larger incision with greater exposure. Its supposed advantages are, that gravity will aid in passing the food downward; and if the button has been used, that it is less liable to be retained in the stomach, and, lastly, that regurgitant vomiting of bile and pancreatic juices is less frequent; all of which are important points in favor of this locality for anastomosis, if true. It is open to question if it is true in any particular, and, so far as I have been able to judge from a somewhat careful examination of the literature, there is in reality no difference in the results, and, as the anterior operation is simpler, I prefer it. Carle and Fantino apparently demonstrated the superior advantages of the posterior operation. These investigators also showed by experimental work that bile was frequently, if not usually, present in the stomach for three months after gastro-enterostomy, and in moderate quantities did not interfere with digestion. On

the contrary, at the Breslau clinic the anterior method gave the best results. If the posterior operation is chosen, the suggestion of Meyer, that the edges of the divided mesocolon be sutured to the posterior wall of the stomach, should be carried out to prevent contraction of the mesenteric opening. For the anterior operation, a point on the healthy portion of the stomach should be chosen as near the pylorus as will probably remain free from encroachment of the disease. It should be placed near the greater curvature.

In my cases I have tried to get the lower border of the anastomotic opening about one inch above the inferior border of the stomach. When completed the traction weight of the attached bowel draws the stomach over until at the point of attachment the anterior wall becomes the inferior, and a funnel-shaped entrance into the bowel is secured. This can be readily observed before closing, by lifting up the abdominal wall with a retractor, exposing the field of operation. I believe that this mechanical condition in the completed gastro-enterostomy prevents to a large extent the vicious circle of the biliary and pancreatic juices which has proved so prolific a source of danger to the patient.

The anterior operation has usually been made too high up on the stomach wall. The anastomosis should be at a low point, so that gravity will empty the stomach and prevent the entrance of bile. In eleven anterior gastro-enterostomies which I have made for malignant disease, in only two cases was regurgitant vomiting marked. One subsided after a single stomach lavage and the second required lavage once or twice a day for five days, both cases recovered. Of twenty gastro-enterostomies made for non-malignant disease in none was regurgitant vomiting present. It is a more common complication of malignant disease, and perhaps in part due to the changed nutrition affecting the glandular secretions as well as the reduction in the motor power so characteristic of cancer of the stomach.

Entero-anastomosis between the proximal and distal limbs of the jejunum as advocated by Jaboulay-Braun to prevent this

complication has been considered of value by Weir. The latter uses a small Murphy button for the purpose, and with long forceps introduces each half of the button from inside the lumen of the intestine, making a small opening through the intestinal wall large enough to admit the cylinders and clamps without sutures. Mikulicz made entero-anastomosis four times after regurgitant vomiting had commenced, as a secondary operation, with success in checking regurgitation. Doyen has recommended that the bowel be divided and the distal end anastomosed to the stomach, the proximal end being joined to the small bowel, in this way avoiding, as he believes, the danger of the vicious circle and preventing dilatation of the proximal portion of the loop.

Rutkowski adds to the gastro-enterostomy a Witzel or Kader gastrostomy, and introduces a rubber tube, from the surface through the external fistula and the stomach, into the intestine by way of the anastomotic opening. Witzel speaks highly of this method both in preventing the establishment of a false route and also as providing a means of early feeding through the tube. It has been recommended that the tube be fastened into the gastro-enterostomy opening by an absorbable suture to prevent it from slipping upward into the stomach. The necessity for such complicated operations for the purpose of preventing regurgitant vomiting is open to serious question. Czerny had only one fatal case of intestinal regurgitation in sixty-five gastro-enterostomies, and this case was complicated by free hæmorrhage from an ulcerating carcinoma. Czerny believes the button prevents spur-formation while in place, and prefers the posterior operation. Mikulicz had seventy-four gastro-enterostomies in the Breslau clinic with twenty-four deaths, spur-formation accounting for six, or 25 per cent. of the mortality. In the fatal cases due to spur-formation the proximal loop was enormously distended and the intestinal tract empty, the patients dying of starvation. The latter operator abandoned the posterior operation on this account. At the time of the report he was using the anterior method with the Murphy button, and his results were very

satisfactory. The suture operation of Wölfler brings the lateral wall of the jejunum to the side of the stomach, and Senn fixes the bowel at several points each side of the opening to prevent angulation, and favors a long visceral incision to prevent contraction. Kocher loops the bowel up in such manner as to produce a rather marked angle, the anastomosis being at the apex of the knuckle. Fenger has modified the anterior suture operation of Kocher in a most important particular, and theoretically it would appear to be a good method. The suturing is proceeded with as in the Kocher plan, but from the middle of each half of the anterior surface of the stomach and bowel; an incision from three-quarters of one inch to an inch in length is made, that is, from the centre of the unfinished upper half towards the lesser curvature of the stomach and downward along the convexity of the bowel to the same extent. On closing this wound the anterior portion of the anastomotic opening is greatly lengthened and spur-formation with its attendant evils may be prevented. It is not so injuriously affected by future contraction as the Kocher operation. Fenger's modification simply performs the office of "Pyloroplasty" upon the anterior surface of the opening.

In the hands of its originator the results in three cases have been highly satisfactory.[1] The writer has used the Murphy button in all of his operations and has been satisfied with the results. Death followed three out of eleven gastro-enterostomies for malignant disease and in only one out of twenty non-malignant cases. In no case was the button found to be at fault. Two died of aspiration pneumonia and two of exhaustion. A form of collapse after operation for malignant disease in the abdomen coming on about the fourth day, in my experience, has been a rather frequent fatal termination. The post-mortem does not show adequate cause for the exhaustion. In the Breslau clinic collapse was given as the cause of death in thirteen out of twenty-four fatal cases.

In using the button, the female half should be placed in

[1] In a later communication Fenger reports a fourth case which died from regurgitant vomiting.

the intestine first after a preliminary purse-string suture. The stomach wall should be cut to the mucous coat before placing the suture, and the latter should be close to the margins of the incision to render approximation easy, otherwise the thick wall of the stomach will ruffle up and expose the suture at some point. This is less true of malignant disease than non-malignant, as the shorter period of obstruction does not permit of adequate compensation, and the ability to develop muscular structure is deficient.

Kummel placed the stomach half of the button in position and *closes* the incision to the cylinder by sutures. In a later report Kummel says that he has since had an accident from this cause, and he has now returned to the purse-string suture of Murphy. Kammerer speaks of the button as being especially adapted for the posterior operation and the suture for the anterior. Supplementary sutures outside of the button are unnecessary, and may prove a source of danger. I have never used them. In using the button one should be careful to prevent a hæmatoma infiltrating the walls of the stomach outside the grasp of the button, as the sloughing process may cause an infection of the clot and perforation beyond the limiting adhesions. The main objection made to the button is that it often falls back into the stomach; this occurred in a number of my cases, and no harm has resulted. Weir and Kummel have each modified the intestinal half of the button, enlarging it in such a way as to prevent its passing into the stomach.

I do not know of the value of the modification. Malthe says that if the button in position lies to the right of the spinal column it will pass downward, if to the left it will drop back into the stomach. For some time I have paid no attention to the passing of the button. It saves the patient much anxiety, and is often passed after leaving the hospital without his knowledge. Meyer speaks of finding the button in the rectum in many of his cases. Colicky pains and symptoms of obstruction may appear while the button is in transit, this readily subsides by prohibiting food for a short time.

Contraction of the anastomotic opening after the button

operation does not often occur. Meyer was able to find only one case. That some contraction should take place with the diminished size of a dilated stomach is to be expected, but in none of my cases has failure to empty the stomach properly occurred after the operation and for non-malignant disease. I have one case of over six years' duration and several beyond three years. Gastro-enterostomy for malignant disease has a mortality of about 38.3 (Robson). Czerny in 65 recent cases had a mortality of 38.5; Mukulicz, 74 cases, mortality 32 per cent.; Perman, of Stockholm, 42 cases and 15 deaths.

Section 6.—The special preparation of the stomach for operation is of importance. Under normal conditions bacteria do not flourish in the stomach, although present under ordinary food conditions. With carcinoma, motor insufficiency, retention, and in the later stages ulceration, present conditions favoring development of germs as well as the saprophytes of putrefaction. In Halsted's clinic, Cushing has been able to secure a high degree of sterilization of the stomach by means of careful antiseptic cleansing of the teeth and mouth and heat sterilization of the food. Lavage as a means of aiding the cleansing process is very necessary. The mechanical removal of the gastric contents washes out the unabsorbed food products and prevents decomposition.

Guillot does not favor lavage immediately prior to operation upon the stomach, believing that it tends to weaken the patient at a critical time. Purgation before the operation he also opposes on the same grounds. Among surgeons generally the opposite view is held, lavage and purgation being considered essential as preliminary preparation.

The writer does not ordinarly favor marked changes in the diet of surgical cases shortly before operation. The patient of average intelligence can materially aid the surgeon in selecting articles of diet which experience has taught him cause the least harm. If these articles can be sterilized by cooking and the remains be removed by stomach lavage before decomposition occurs, we will have accomplished something in the way of securing a proper wound site. Undoubtedly a greater amount of good would be accomplished by a diet be-

ginning some days before operation, but the necessary experimentation to secure proper feeding takes valuable time, and the immediate result is often to temporarily disarrange the already enfeebled digestive power. Attempts to add to the patient's strength before operation by rectal feeding to supplement stomach absorption may be objectionable. In many cases the rectum becomes intolerant after a few days, and its value may in this way be seriously impaired for carrying on nutrition after operation.

My own experience has been that the patient does fully as well if either method alone is employed. Not more than a few days should be spent in preliminary preparation. The stomach should be carefully emptied of its contents just previous to the operation; this is seldom as successful as one could wish. Often the wash-water will return quite clear, and on opening the stomach a few moments later, a quantity of dirty fluid will be encountered. This renders accidental wound soiling possible, and in elevating the stomach out of the abdominal incision gravity may cause the fluids to pass into the œsophagus.

Aspiration pneumonia under such circumstances is very liable to occur after operation. I had two deaths from this cause. Fifteen out of a total of twenty deaths after stomach operation in the Heidelberg clinic were from pneumonia. Czerny does not think it is due to the anæsthetic, as it occurred twice in five cocaine operations, and, as it often came on in the first forty-eight hours, it could not be due to confinement to bed. In his experience it was most common in males with a previous bronchitis or emphysema, and due, he believes, to the incision interfering with abdominal respiration. In debilitated cases very little anæsthetic is needed,—a preliminary hypodermic of morphine with just enough ether or chloroform to enable painless division of the abdominal coverings and again to close. No pain is felt during the gastro-intestinal manipulations. Local anæsthesia by cocaine in very debilitated subjects is an ideal method, provided the operation is short and does not require traction on the margin of the abdominal incision.

Abbe and others have used it to a considerable extent in

stomach surgery. The experience of Bloodgood and Cushing in hernia work and Matas in cocainization of nerve trunks suggests a wider field for its employment. The after care is mainly to counteract shock, which the nearness to the great sympathetic ganglia and direct injury to the terminal filaments of the vagi often renders severe. Morphia, strychnine, and atropia are useful to meet indications, and, if necessary, saline infusions. Rectal enemata of hot saline solutions or coffee are valuable adjuvants to prevent collapse. After the immediate danger has been overcome every effort to prevent exhaustion and death at a later stage must be made. The majority of surgeons prefer rectal feeding for the first few days. Successful rectal feeding requires experience and good judgment; the tendency is to over-feed and to use larger quantities than are well borne. The need of liquids is most apparent, and large enemata of saline solution at least once in twenty-four hours meet this indication. In my earlier cases, I am convinced that I withheld stomach feeding longer than was necessary. The general tendency is to earlier feeding by the mouth and less reliance is placed on rectal alimentation. Rectal feeding carries the patient along, but is inadequate and the patient does not gain.

Guillot begins liquid nourishment by the mouth two hours after partial stomach extirpation, and Roux gives whatever the patient desires and as soon as called for. This practice shows great confidence in the methods of suture in preventing leakage; but after an abdominal operation of this magnitude digestion for the first twenty-four hours is nearly at a stand-still, and food under such circumstances is liable to do harm. Chlumsky, in his experiments as to the strength of union after intestinal anastomosis, demonstrated that from the third to the fifth day the union was weakest. There was little difference between the button and the suture in this respect. These conclusions are borne out by clinical experience, and care should be exercised in feeding until union is complete. Elderly people bear confinement to bed badly, and do much better if allowed up within the first week.

NOTE ON THE RELATION OF THE OS MAGNUM TO TUBERCULOSIS OF THE WRIST-JOINT.

By DAVID EDWARD MUNDELL, M.D.,

OF KINGSTON, ONTARIO.

In May, 1899, I was consulted by Mrs. W., aged thirty-six, who gave the following history: When nineteen years of age she began to suffer from pain in left wrist. In about a year and a half the wrist became swollen, and finally, after suffering more or less for five years, an abscess formed and "broke" in upper part of palm near wrist. The sinus continued to discharge for about two years, but during most of this period of seven years she could use the wrist to some extent. Inquiry elicited no family history of tuberculosis, and during the succeeding ten years her wrist did not trouble her, but about two years ago pain, gradually increasing in severity, returned. When seen by me the wrist was enlarged and fusiform, and any movement of the joint was painful. Pressure over carpus elicited a very sensitive spot on a line between the bases of index and middle fingers. X-ray examination presented the appearance as seen in the accompanying skiagraph, the radius and ulna not being involved, though the carpal bones are. Rarefaction is most pronounced in the os magnum. Iodoformized glycerin and Bier's method were tried, but the pain continuing excruciating, excision was advised, and, being accepted, Ollier's method was followed. Instead of removing the carpus *en masse,* the neck of the os magnum was divided so as to permit freer access to semilunar and scaphoid, which, with the other bones, were easily removed with the assistance of a dental root elevator. In a letter received a short time ago from her, she stated that she has been free from pain since the operation; there is no ulnar flexion, and she can perform her household duties as well as ever.

In June, 1897, I saw Mrs. M., tubercular parentage, who gave a history of swelling of wrist of two years' duration accompanied

by gradually increasing pain. The skiagraph showed rarefaction of the carpal bones, most marked, however, in the os magnum. The usual treatment had no effect, but she would not submit to operative interference. She died about a year afterwards from acute pulmonary tuberculosis.

A third case, a Mrs. R., stated that her mother, two sisters, two aunts, and two uncles had died from consumption. From the age of three until eleven she suffered from cervical adenitis, necessitating the removal of the glands. About six years ago she sprained her wrist, and since then swelling accompanied by severe burning pain has been constant. For the last two years a splint had been worn, but during this period she had very little rest night or day except from the use of morphine. The X-rays showed tubercular disease of the carpus, involving the os magnum to a greater degree than the other bones. A partial excision was done through a single posterior incision, removing the bones as described above, but leaving the pisiform and trapezium.

The results in this case are equally as good as in Case I. On examination of the skiagraphs of the cases above reported, the involvement of the os magnum, showing that the disease had started in this bone, or, if not, had made most progress in it, arrested my attention; and on looking through the collection of the superintendent of the General Hospital the prominence of this bone as a factor in the development of tuberculosis of wrist-joint was emphasized, for in the three cases in his collection the os magnum showed most disease. Tubercle bacilli manifest themselves in bone by a process of rarefaction; hence that bone, most rarefied, would in all probability be the one in which the processes are most active. It is hardly likely that the disease would start in all simultaneously and develop to such a degree that the os magnum, as shown by the skiagraph, would be almost entirely destroyed, and some of the others hardly involved; hence, the inference is that in the os magnum the tubercular process first began. Ollier emphasizes the importance of juxta-epiphyseal strain in the production of tuberculosis of long bones. And on the same principle, repeated strains on any bone may favor tuberculosis on account of minute foci of inflammation resulting from the "jarring"

of the trabeculæ. As an explanation of why this would likely affect the os magnum, the following considerations seem pertinent. The os magnum is a pivot, being the central and main bone of the carpus, and articulates with seven other bones, the unciform coming next with five articulations, and, being superimposed on the middle or chief metacarpal, it would receive the effects of traumatisms to which the latter is subjected, as well as those of the index- and ring-fingers with which also it articulates. Again, the midcarpal joint, composed principally of the os magnum and tip of the unciform which form an enarthrodial joint with the semilunar and scaphoid, participates in every movement of flexion and extension of the wrist. And as two strong bands—oblique fibres of anterior annular ligament from both radius and ulna and the radial fibres of posterior ligament, as well as accessory bands from semilunar, scaphoid, and unciform—are attached to this bone, it follows that, in the frequent movements of the midcarpal joint, the tension of these ligaments causes strain on the os magnum. Following out her general rule of strengthening weak parts, or of assisting them to resist traumatism, Nature has caused the centre of ossification to appear earlier in this than in the other carpal bones,—a few months before the unciform, which is also subjected to strain, though in lesser degree and years before those of the other bone. Further, she hastens the ossifying process in the os magnum, since, in a child of two and a half years of age, I found that, though the centres for the os magnum and unciform had started within a few months of each other, that for the os magnum measured six millimetres, while in the unciform it was only three millimetres in diameter.

Again, as the posterior border of the overhanging receiving cavity for the os magnum is more prominent than the anterior border, a greater amount of flexion than extension is permitted at the midcarpal joint; hence the posterior surface of os magnum would be subjected to greater strain than the anterior, from the tension of the ligaments resisting flexion; and I found the ossifying process developed more towards the posterior aspect of the bone than the anterior, so that there was

only a thin shale of bone between the centre and the posterior surface, whereas, in front, there is an appreciable wall of two millimetres. At ten years of age I found that while the other bones exhibit a varying degree of ossification the os magnum is almost completely ossified. These facts would seem to indicate provision against, and therefore acknowledgment of, the greater amount of strain on the os magnum. On making a coronal section of a fresh adult bone, there appears a slight condensation of osseous tissue on the radial side of section, and on a forced injection of an arm with carmine gelatin the main vascular supply was on the posterior aspect of the bone, and the cancellous inner portion was more richly supplied with blood than the slightly more compact outer part. Summing up, then, the above considerations, we find that the os magnum, the main bone in the wrist, is the earliest to ossify; that it is so situated as to receive the effects of injuries from three metacarpal bones; that it performs more movement in flexion and extension than the other bones; that in these movements greater strain is thrown on it than on the other carpal bones, from the numerous ligaments connected with it and resisting such movements; that the cancellated structure of the os magnum is uneven; that that portion, the inner, which has the wider spaces, and is therefore less strong, has a richer blood-supply. For the above reasons, it seems to me that vibrations the result of traumatisms would affect the os magnum more often than the other carpal bones, and especially that portion of it referred to above which consists of less numerous trabeculæ. Therefore it would seem reasonable that tubercle bacilli in the blood or lymph would be more prone to concentrate here than in any of the other carpal bones, and would in all probability involve the inner portion of the bone.

Lastly, the pain has been described by patients as of a burning, aching character, and, in my opinion, is the result, in the early stage of the disease at least, of pressure on the synovial membrane between the os magnum and trapezium, because these two are more closely bound together than any of the other bones; hence the enlargement of the os magnum

from the tubercular process—though this enlargement would be very slight, for tuberculosis of bone is accompanied by very little increase in size—will be sufficient to "nip" the synovial membrane between it and the trapezium. The point of greatest tenderness in the above cases was on a line between index- and middle-finger, corresponding, therefore, to this situation. Again, Barwell, in "International Encyclopædia of Surgery," states that in tuberculosis of wrist-joint the point of special tenderness is on the outer side of the extensor indicis tendon, a situation corresponding to the junction of os magnum and trapezium.

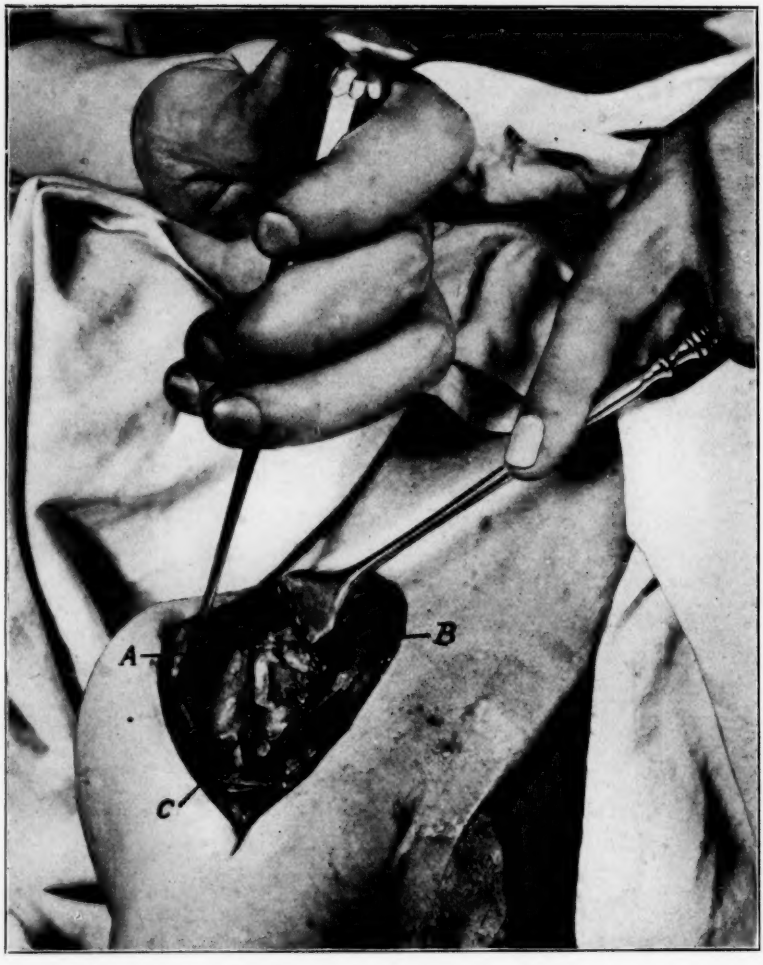


FIG. 1.—*A*, External shell of bone (major tuberosity held outward by chisel); *B*, internal shell of bone retracted inward; *C*, bicipital groove.

A METHOD OF EXCISION OF THE SHOULDER-JOINT.

By JOHN FAIRBAIRN BINNIE, C.M.,

OF KANSAS CITY, MO.

In excising the shoulder-joint, the principal difficulty encountered is the separation of the tendinous insertions into the major and minor tuberosities of the humerus. Whether this separation be accomplished with the periosteal elevator, the knife, or the scissors, much time is consumed, and the tissues are usually left in a very ragged condition. In the case of the hip- and ankle-joints, König has overcome similar difficulties by chiselling a shell of bone from the trochanter major or the malleoli, and retracting this osseous shell with its periosteal and tendinous attachments. König's method of hip and ankle excision has so much to recommend it on account of its simplicity, if for no other reason, that the writer ventures to urge its application to the shoulder-joint.

The Operation.—Step 1. Expose the joint by Ollier's method. Abduct the arm, and have an assistant hold it in a position of nearly a right angle to the axis of the trunk. From a point one-half inch below the clavicle and beside the coracoid process, make an incision four and one-half to five inches in length, directed downward and outward towards the insertion of the deltoid. The incision divides the skin and subcutaneous tissue. Distinguish the outer border of the deltoid. Incise the deltoid a little to the outside of and parallel to its internal margin, thus avoiding injury to the cephalic vein and a large branch of the acromio-thoracic artery. Retract the outer side of the wound (skin and deltoid), thus exposing the head of the humerus.

Step 2. Rotate the arm so as to make out the bicipital

groove. Incise the joint capsule throughout its whole extent parallel and external to the tendon of the biceps. Place a chisel in position against the outer margin of the bicipital groove and cut the great tuberosity separate from the shaft. Reflect outward the detached shell of bone (major tuberosity) with all its connections, both tendinous and periosteal. Lift the long head of the biceps outward after freeing it from its synovial sheath. With the chisel cut the lesser tuberosity free from the shaft of the humerus. Retract inward the shell of bone (minor tuberosity) with its tendinous and periosteal connections, and with the long head of the biceps. Dislocate the head of the humerus into the wound, at the same time severing its posterior attachments with elevator, or scissors, in the usual manner.

The rest of the active operation is completed in the usual well-known manner. The shells of bone (the tuberosities) which remain attached to the periosteum are examined, and, if diseased, removed; if free from disease, replaced. In replacing them, one or two points of suture, uniting their non-osseous connections, should be so placed as to keep the long head of the biceps superficial to them. The closure of the wound and after-treatment present nothing novel.

The operation described above is so simple and saves so much time that the writer believes it must have been described by others, but never having seen such a description, he ventures to bring it before the surgical public.



FIG. 2.—*C*, Bicipital groove.

REPORT OF A CASE OF STRANGULATED OBTURATOR HERNIA.

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THERE are, comparatively speaking, not many cases of obturator hernia reported in surgical literature, and all the text-books agree in placing it among the rarer forms of hernia.

Sajou's "Cyclopædia of Practical Medicine" mentions it as a rare variety, placing it last on the list, after such forms as perineal, ischiatic, and hernia through the foramen of Winslow, and gives no literature on the subject. The "American Text-Book of Surgery" gives about the same information, while the "International Text-Book" (1900), though describing it as a rare variety of hernia, does give the symptoms and some rules for treatment.

In the London *Lancet* for May, 1895, Mr. W. H. Bennett, of St. George's Hospital, reports a case occurring in a woman, aged seventy-eight, whose symptoms and treatment were so identical with the present case that I shall not repeat them. She, too, was discharged cured in three weeks.

In the same journal for April, 1896 (quoted by "American Year-Book of Medicine and Surgery" for 1897), W. Anderson, of St. Thomas's Hospital, reports two cases, one of which was bilateral, the recurrence on the second side coming on while the patient was still in hospital under treatment for the original hernia of the opposite side. In reporting these cases, he remarks, "Obturator hernia is one of the rarities of surgical practice, only one case is mentioned in the surgical records of this hospital from 1870 down to date of these two

cases, and only thirty cases have been recorded as operated on in Europe down to the present day" (1896).

CASE I.—Woman, aged seventy-one, gave a history of repeated attacks of intestinal obstruction. A tumor could be felt at inner margin of Scarpa's triangle, and this proved to be a strangulated hernia through the upper part of obturator foramen. It was reduced from the outside with relief of symptoms, and patient did well. Twenty-six days later a similar hernia appeared on the opposite side, and, as the patient had not yet left the hospital, she was at once operated on by the same method as formerly, and was ultimately discharged well, though wearing a double truss.

CASE II.—An old woman; strangulation for some time, fæcal vomiting, with great prostration. Laparotomy was done, but patient died on the table. Mr. Anderson then gives the best description I have yet read of the surgical anatomy of the obturator foramen and its surroundings.

In the *Lancet* for June, 1897, Mr. R. Godlee, of University College Hospital, cites three operative cases, all women, varying in age from forty-seven to seventy-four, and all fatal. Laparotomy was done in two of these three, while the other was operated on from without, and the tumor reached by separating the fibres of the pectineus muscle and its underlying fascia. In all cases the strangulation had been present for some time, and there was gangrene of the bowel. Here, again, the chief symptom was (as it always is) that due to obstruction, and only in one could any tumor be made out, or was there any pain referred down the obturator nerve. Mr. Godlee advises a combined external and internal operation, so that through the laparotomy wound one could pull on the strangulated loop of bowel, while, at the same time, through an opening down to the obturator foramen, made at the inner side of Scarpa's triangle, one could more readily disengage the strangulated gut, which Mr. Godlee found he had torn in one of the laparotomy cases.

The case I now wish to report is that of a maiden lady, aged seventy-three, of very spare habit, whom I was called to see on December 13, 1899.

The following history was given: Three days previously she received a sudden jar by missing a step at the bottom of a stairs, and at once felt a severe pain across the lower zone of the abdomen and shooting down right thigh to the knee. She was, however, able to walk about half a mile to her home, where she soon began to be nauseated, and vomited shortly afterwards. Her condition was not regarded by herself or her friends as serious until I was called in on the third day. The vomiting had by this time become markedly fæcal in character and odor; there was marked distention of the abdomen, and she was very weak, but there was no evidence of peritonitis. The bowels had not moved since accident. Temperature, 101° F.; pulse, 112. She had, in fact, all the symptomsof intestinal obstruction, and I was unable to make any more definite diagnosis, having examined her, in vain, for any hernial tumor. I advised immediate opening of the abdomen, with a view, if possible, to find and relieve the cause of obstruction, but her condition was so bad that I could not hold out much hope of a successful result. Consent being readily given, I at once had her conveyed to the Montreal General Hospital, and made arrangements for immediate operation. Just before going on the table, she was given an enema of peptonized milk four ounces, somatose half an ounce, and brandy one ounce, which she retained. The patient was then etherized and prepared for laparotomy in the usual way. A median incision below the umbilicus was made, and distended small bowel at once presented. Although the gut was deeply injected, there was no peritonitis. On pushing aside the distended bowel, collapsed small bowel was seen. This was followed down into the pelvis, behind the right pubic ramus, until it was felt to be tightly grasped at the upper part of the obturator foramen. A coil of the distended bowel was traced up from the same spot, which was thus proved to be the point of obstruction. Pulling on these two lines of bowel with one hand, I managed, with some difficulty, to disengage the knuckle of bowel from the foramen, separating the adhesions with the index-finger of the other hand. This strangulated knuckle, when brought into view, was inky black, but the discoloration only extended around three-quarters of the circumference of the bowel, and did not involve the mesenteric vessels. It was a Richter's hernia, in other words, though sufficient to produce complete obstruction. The application of hot towels to

the black spot for a few minutes completely restored the circulation, and, as the mesenteric vessels had never been compressed, I had no fear of subsequent gangrene, and therefore dropped the bowel back into the abdomen. I made no attempt to close the obturator opening, and indeed, on subsequently feeling for it, could not definitely make one out; and as my patient's condition was not, by this time, very good, I filled the abdominal cavity with warm normal saline solution, and quickly closed the abdomen without drainage. I have before used saline solution in this way in laparotomies, especially if the patients were much exhausted or exsanguinated (as in a ruptured ectopic pregnancy), and always with the best effect, and moreover find it prevents, in a great measure, the excessive thirst which is so apt to torment these patients for the first twenty-four or thirty-six hours after such operations.

The patient only vomited four times after operation, and within four hours of her return to the ward could take milk and soda without nausea. With the exception of an annoying attack of cystitis, which I attributed to careless catheterization for the temporary retention of urine immediately following the operation, the patient made an uninterrupted recovery. The wound healed by "first intention," and the old lady left the hospital, cured, on the twenty-first day after the operation, and is to-day in excellent health.

REPORT OF A CASE OF IRREDUCIBLE BACKWARD DISLOCATION OF THE BONES OF THE LEG AT THE KNEE-JOINT.

By LEONARD C. HULL, M.D.,

OF HOLLISTER, CAL.

October 24, 1897, Mrs. B. was thrown from her horse, alighting, as she believes, on her feet, and then falling to the ground. When seen by the reporter, some seven hours after the accident, in addition to a wound over the internal condyle of the right femur, exposing the bone, the patella was missing from the intercondyloid notch, and the bones of the leg, notwithstanding the great swelling of the joint, were located high up in the popliteal space. The leg was shortened, rotated laterally, very much swollen, and cold from the obstructed circulation. Under chloroform, a prolonged attempt was made to effect reduction, but without success. She was therefore brought into the town, a distance of thirty miles, where, the next day, with the assistance of Dr. Porter, a prolonged attempt, using all the force consistent with safety, was made to effect reduction, still without success. On account of the infected wound and the surroundings of the patient, it was deemed inadvisable to resort to any operative procedure at the time. In the course of the following three months, on account of pressure, another wound, the size of a fifty-cent piece, appeared over the external condyle of the femur. This wound, with the one which occurred at the time of the accident, under the influence of rest and cleanliness finally healed. Being fearful of an operation, and in the hope that the leg would in some measure serve for locomotion, the patient, after the external wounds were healed, attempted to walk with the assistance of crutches. The leg being shortened to the extent of four inches, and having no support except the soft structures behind the knee, pressure against which caused pain and swelling, it became evident that the leg was not only of no use, but in the way; so on June 25, 1898, eight months

after the accident, a resection of the knee-joint was made. The patella was found surrounded by dense adhesions and perfectly fixed near the head of the fibula. The ligamentum patellæ was intact, also the connection of the upper part of patella with the quadriceps femoris. This condition, in my opinion, was the cause of failure to reduce the dislocation, as at the time the effort to effect reduction was made repeated attempts with the leg in different positions to make the patella slip over the external condyle of the femur failed completely. One authority, speaking of dislocation of the knee, says, " On account of the extensive laceration of structures about the knee-joint which must take place before great dislocation can occur, the reduction of such an injury is accomplished with ease." This statement was not borne out by our experience in this case. After dissecting out the patella, an attempt was made to bring the leg in apposition with the lower end of the femur, but, on account of adhesions, this was impossible. The leg was flexed on the thigh as much as possible, considerable force being used; and the adhesions, as they presented themselves, were divided, great care being exercised, as the dissection progressed backward, to avoid wounding the popliteal vessels. In order to bring the leg into position to saw off the articular surface of the tibia, it was necessary to divide both hamstring tendons; and even then quite a section had to be taken from the articular surfaces of femur and tibia before the bones could be properly fitted. The bones were held in position by Wyeth's fixation drills. At the end of seven weeks from date of operation, the patient could bear her whole weight on the leg, the bones having firmly united. In a very short time she was able to discard her crutches, and, with the exception of some swelling in the lower leg after prolonged use of it, there has been no trouble, and at the present time, two years after the accident, she is able to walk with no discomfort and the leg is as strong as ever.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 28, 1900.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

LONG IMMUNITY FROM RECURRENCE AFTER RESECTION OF A SARCOMA OF THE LOWER JAW.

DR. A. B. JOHNSON presented a girl, who first came under his care when four years of age. About the beginning of 1892, or eighteen months before she came under his care, her mother noticed an enlargement of the lower jaw upon the left side and a little removed from the median line. This enlargement continued to increase in size. It was painless, and caused discomfort chiefly on account of its size. An incision had been made into the growth some months before from within the mouth, but without benefit.

Upon examination the child was found to be fairly nourished; a marked deformity of the lower part of the face was noticeable. The mental, submental, left submaxillary, and a portion of the left parotid regions were occupied by a large rounded tumor about the size of a large mandarin orange, the skin overlying the tumor being healthy and not adherent. The mucous membrane of the mouth not ulcerated, the tongue displaced towards the right by the projection of the mass into the floor of the mouth.

The enlargement seemed to include the entire circumference of the body of the jaw. The tumor was smooth, rounded, and hard to the touch. In front a crackling sensation could be produced by pressure with the finger, as though the shell or bone surrounding the mass was very thin.

May 4, 1892, an incision was made from the middle of the chin outward and backward over the growth as far as the angle of the jaw. The tumor was found to extend to the right some

distance beyond the median line, and the jaw was sawn at a point opposite the second incisor tooth on the right side, and again at the junction of the body with the ascending ramus upon the left side. The periosteum appeared healthy, and was spared as far as possible. The patient made a good recovery. Upon inspection, the tumor was found to consist of a thin shell of bone surrounding a large cavity filled with a rather soft tissue of a uniform white-yellowish color. The development of the teeth appeared to be perfect. The soft tissue upon examination proved to be a sarcoma containing round cells and many giant cells.

The patient has been kept under observation since the operation was done; a slow regeneration of bone has taken place, and at present the continuity of the jaw appears to be complete, although the new bone does not at all approach a normal inferior maxilla. For several years the child has been wearing a plate containing some teeth. It seems to be fairly efficient. The deformity is only moderate, if one takes into account the extensive removal of the bone.

One of the chief factors of interest in the case was the regeneration of the bone, which had taken place with exceeding slowness. He had first noticed the new growth of bone about two years ago.

ACUTE INTESTINAL OBSTRUCTION FROM ADHESION BANDS FOLLOWING APPENDICECTOMY.

Dr. Alexander M. Johnson presented a man, aged thirty years, who entered the Roosevelt Hospital on January 8, 1900, with the following history: Fifteen years before he had a severe attack of illness, which seems to have been due to an inflammation of the vermiform appendix. He remained well after recovery from this attack until five months ago, when he had a typical attack of appendicitis, severe in character, confining him to his bed for many days and terminating in an imperfect recovery, the region of the appendix having remained tender upon pressure ever since. Three weeks ago he had another severe attack accompanied by the formation of a tumor in the right iliac fossa. Since then he has lost strength and flesh, and has constantly suffered from considerable discomfort, referred to the region of the appendix.

Upon admission to the hospital his evening temperature was

100° F.; pulse, 84. There was tenderness on pressure and a slight sense of resistance to be felt over the appendix. He remained under observation until January 20, during which time he had a slight evening rise of temperature. The local conditions remained about the same.

Upon January 20 the abdomen was opened by the intermuscular incision of McBurney. The cæcum was found to be firmly adherent upon its outer and posterior surfaces to the peritoneum covering the iliac fossa. After a rather tedious dissection, a small abscess was opened, which contained about one-half a drachm of pus. This abscess was found to communicate, on the one hand, with the open end of an appendix about an inch in length, a considerable part of the organ having apparently been destroyed, and on the other with a small opening in the wall of the cæcum at a point about an inch and a half distant from and below the base of the appendix. The cavity of the abscess was wiped out and the granulation tissue forming its walls was removed with a curette. The hole in the gut was closed with several mattress stitches, the appendix was amputated at its base, surrounded by a purse-string suture and inverted in the intestine.

The necessary manipulations of the cæcum were prolonged and severe. A small drainage wick was placed in contact with the sutured portion of the gut and the cavity of the abscess, and led out through the abdominal wound. The remainder of the wound was closed by sutures. The patient bore the operation well; his temperature rose after forty-eight hours to 101.8° F. He vomited several times on the day following the operation; and, although on the next day his temperature fell to 99°, and remained at that point for the following five days, his stomach continued irritable.

His bowels moved freely upon the third day; the vomiting was greatly diminished in frequency by washing the stomach. The wound remained entirely clean except for the discharge of a small amount of pus along the sinus created by the drainage wick. At the end of a week his condition was entirely satisfactory; but on the eighth day the vomiting recurred. He had had one or more movements daily from the bowels up to this time.

Although the wound remained clean, his temperature rose on the tenth day to 101.8° F. During the ninth and tenth days following the operation he began to vomit more often, and to

complain of pain in the stomach after taking food; his bowels became difficult to move, and upon the tenth day the vomited material changed in character, became of a dark brown color and had a disagreeable odor. He also suffered from severe abdominal pains, and his pulse showed signs of failing strength.

Upon the eleventh day he did not vomit; his bowels moved once; but upon the following day the vomiting and abdominal pains recurred. Upon the fourteenth day this condition was more serious, the vomiting and pain continued, and the vomited material was of a decided fæcal character. Numerous high enemata brought away only small amounts of fluid fæces mixed with mucus and blood. He began to grow very weak and to suffer from abdominal distention with severe abdominal pains. His pulse became very rapid and feeble in spite of powerful stimulations.

On the morning of the fifteenth day the signs of acute intestinal obstruction were unmistakable. His eyes were sunken, his extremities cold, his abdomen distended; he vomited frequently, and the vomited materials were distinctly stercoraceous. The bowels could not be made to move. Accordingly, upon the fifteenth day he was etherized, and a median abdominal incision was made with its centre opposite the umbilicus; the peritoneum was clean, but coils of distended and congested small intestine presented in the wound. These were pushed towards the left, when other coils of small intestine were seen in a collapsed state, which being followed led to the right side of the abdomen in the region of the ascending colon. The ascending colon and two coils of small intestine were found agglutinated into a solid mass. The coils above this mass were distended, those below were collapsed. Upon further examination, a broad fibrous band was seen passing from the ascending colon towards the left, behind it was the outermost coil of small intestine. Its calibre was completely shut off by the pressure of this band. The inner coil did not appear to be completely obstructed, and the band extended across its front to be attached upon the further side to its mesentery. The band was divided and, as far as possible, cut away with the scissors, when the collapsed coils immediately filled from above.

The two coils of small intestine, however, were found firmly adherent to one another over an area represented by nearly half their surfaces, for a distance of about three inches. They were

separated with difficulty. The bleeding during these manipulations was considerable, and the patient's condition indicating an alarming collapse, he received a hot saline intravenous infusion of 2000 cubic centimetres.

Temporary pressure was applied to these bleeding surfaces by means of gauze pads, and the pelvis was explored for other possible causes of obstruction. Numerous bands and broad adhesions were also found between the coils of small intestines situated in the pelvis; although not apparently causing trouble, the bands were cut away. The broad adhesions were let alone. The bleeding here was checked by temporary packing. The coils of small intestines which had been obstructed were moved as far as possible towards the left side of the abdomen. The site of the operation was thoroughly washed with hot salt solution and wiped dry.

The abdominal wound was closed with sutures except at its lower part, where an opening was left for two strands of gauze, leading from the bottom of the pelvis and from the inner side of the ascending colon, where it had been adherent to the small intestines. Although very weak, the patient responded to the most active stimulation, and upon the following day a small movement from the bowels occurred as the result of an enema. His temperature rose to 102.4° F. at the end of forty-eight hours. He was fed chiefly per rectum for two days, after which, the vomiting having subsided, he was given liquid nourishment by the mouth. At the end of forty-eight hours an abundant movement of the bowels occurred, after which movements occurred regularly without trouble. His abdominal wound healed for the most part per primam, and he has now almost a linear scar. The abdominal wound remained clean, and the packing was removed at the end of the fifth day and replaced by a much smaller quantity. His convalescence has been slow but uninterrupted.

DR. HOWARD LILIENTHAL asked why Dr. Johnson had waited until the fifteenth day before doing the second operation. Given a history of previous operation for an inflammatory abdominal disease, why should one wait for fæcal vomiting, or even vomiting approaching that in character, before operating?

Dr. Lilienthal said he had had three cases somewhat similar to the one reported by Dr. Johnson. In one of them the secondary obstruction came on a number of months after the primary opera-

tion, and in the other two a few weeks afterwards. In all three of them, the speaker said, he operated just as soon as the symptoms pointed to an abdominal obstruction, without waiting for fæcal vomiting. All three patients recovered.

Dr. Johnson said that his patient gave a history of always having had a sensitive stomach, and the vomiting commenced immediately after the primary operation. Furthermore, the intestinal obstruction was not complete, the patient a number of times passing small quantities of gas and fæces. At times the vomiting ceased entirely. The primary operation, Dr. Johnson said, was done to relieve a chronic appendicitis; and, although a small abscess communicating with the appendix was found, there was no general invasion of the abdominal cavity, consequently, extensive peritoneal adhesions were not expected.

A FURTHER STUDY OF STARVING MALIGNANT GROWTHS BY EXCISION OF BOTH EXTERNAL CAROTIDS.

Dr. Robert H. M. Dawbarn read a paper with this title.

In connection with this paper, Dr. Dawbarn presented four patients upon whom he had operated by this method.

Dr. George E. Brewer asked Dr. Dawbarn whether he thought excision of the arteries was necessary in the case he had reported of giant-celled sarcoma of the jaw, which he was able completely to remove. It is quite unusual to observe recurrences after the complete removal of an epulis.

Dr. Willy Meyer said the same question had occurred to him. We know that if the so-called epulis or giant-celled sarcoma is freely excised, the result is usually good, and even after a single recurrence it is questionable whether such a radical operation as excision of both external carotids should be resorted to for this purpose. After a second recurrence, that procedure might be advisable.

Dr. Meyer said that in June, 1890, at the German Hospital, he tied both external carotids as a preliminary step to excision of the superior maxilla for sarcoma. This rendered the operation almost entirely bloodless. It was certainly advisable to do this in every instance where the patient cannot afford to lose much blood. In the case he referred to, the tumor had already invaded

the orbit and involved the temporal region. Recurrence set in, to which the patient succumbed ten months later. The speaker said he had never resorted to excision of both external carotids, as suggested by Dr. Dawbarn. The expedient appeared, however, very reasonable, and should be carried out in suitable cases.

DR. F. KAMMERER said he had operated on a number of cases of epulis, and to his knowledge there had never been a recurrence after a liberal removal of the growth, when the tumor was of the giant-cell variety.

DR. DAWBARN said he had employed general anæsthesia in all his cases. The speaker said that in his single case of giant-celled sarcoma, with epulis, he was partly influenced to resort to the radical procedure of excising both external carotids by the fact that the patient was a young woman, whose beauty—and, consequently, her future matrimonial chances—would have been greatly marred by a recurrence, which would have necessitated excision of the upper jaw. We know that even giant-celled sarcoma sometimes recurs, and that with other forms of sarcoma a recurrence is the rule. To this rule, the case shown by Dr. Johnson was apparently a remarkable exception, especially as the periosteum had not been removed.

CYSTIC DISTENTION OF THE INTERNAL SAPHENOUS VEIN SIMULATING A FEMORAL HERNIA.

DR. DAWBARN presented a specimen obtained from a woman, sixty years old, who was admitted to the Polyclinic Hospital on January 1, 1900, with the diagnosis of left femoral hernia of six weeks' standing. She had a swelling, about as large as a hen's egg, in the left femoral region, which she stated had come on after lifting a heavy washtub. Upon straining, the tumor would increase in size somewhat, and taxis would make it disappear, which it did without gurgling.

Dr. Dawbarn said that, after examining the patient, he suspected a strangulated femoral hernia. An incision, however, revealed that the swelling was nothing more than a sacculated dilatation of the internal saphenous vein at its upper end. The patient made an uneventful recovery, and returned to her home on the tenth day. She had no varicosities in other regions of the body.

DR. KAMMERER said that about a month ago he was asked to see a patient at St. Francis Hospital,—perhaps the same one upon

whom Dr. Dawbarn had operated. The patient was a woman who had been sent in with the diagnosis of a femoral hernia. There was slight impulse upon coughing. Dr. Kammerer said that after a careful examination of the patient he became convinced that the case was not one of hernia, but a dilatation of the saphenous vein.

Dr. Brewer said that only a week ago he had a case of supposed double femoral hernia referred to him, which proved to be one of dilatation of the saphenous vein on both sides. In this case there was a distinct impulse upon coughing. The unusual softness of the tumors led one to suspect their true nature.

Dr. John B. Walker said he had seen quite a number of these cases at the Hospital for Ruptured and Crippled. The diagnosis can usually be made by having the patient lie down, when the tumor disappears, the blood imparting a certain thrill to the finger as it passes out.

CARCINOMA OF THE ŒSOPHAGUS.

Dr. F. Kammerer presented a specimen obtained from a man, about fifty years old, who came to the hospital with symptoms of very severe dyspnœa, which he stated had existed for about three weeks, and was gradually increasing in severity. There was nothing to be seen about the neck. The laryngoscope showed a paresis of the right vocal cord. An inferior tracheotomy was then done, which showed that the obstruction to breathing was located below the point of exit of the trachea from behind the sternum. A rubber drainage-tube was inserted for about three inches through the tracheotomy wound; at this point it met with distinct resistance. A smaller tube, however, could be made to pass farther down.

A week later, while the patient was apparently breathing with comparative ease, he suddenly died at night. The autopsy disclosed a very small epithelioma of the œsophagus, which had given no symptoms, and a large lymphatic node which pressed upon the trachea and which had been the cause of his dyspnœa.

In connection with the above case, Dr. Kammerer exhibited a modified König's canula. The modification consists in a strong silver wire running within the lumen of the canula on the concave side; this prevents the spiral part of the canula from unwinding. The speaker said that all who have used König's canula

know that, during its repeated necessary removals, the spiral is apt to be stretched, thus rendering the instrument useless.

IRREDUCIBLE GANGRENOUS FEMORAL HERNIA.

DR. KAMMERER presented specimens obtained from a man, forty-five years old, with a femoral hernia which had become irreducible two weeks before. The operation disclosed a Littré's hernia. On one side of the loop the furrow in the intestinal wall almost reached the mesenteric border, on the other it was distant from it about half an inch. The history corresponds with the condition found. The man had passed gas and fæcal matter to some extent continuously during the two weeks of strangulation, but for the past few days he had also had fæcal vomiting. At the time of operation there were several perforations beneath the constricting ring, and general peritonitis was well established, of which he died on the second day.

REVIEWS OF BOOKS.

LEHRBUCH DER SPECIELLEN CHIRURGIE FUR AERZTE UND STUDIRENDE. Von DR. FRANZ KOENIG, Ord. Professor der Chirurgie, Berlin. III. Band. Berlin, 1900. Verlag von August Hirschwald.

This is the third volume of the seventh edition of this work. Six years have elapsed since the appearance of the sixth edition. During that time surgery has made no inconsiderable progress; and Koenig himself has left Goettingen, to which he had seemed inseparably attached, assumed charge of the universitaetsklinik in Berlin, and accepted the professorship of surgery in the university, a distinction which for many years he had been able to resist.

This volume follows very closely the lines of the previous edition, a review of which appeared in the ANNALS OF SURGERY, soon after its publication. About twenty-five additional woodcuts have been introduced, and the text has been revised and amplified. This volume deals only with the surgery of the spine and of the upper and lower extremities. Its chief defects are those which obtain in the other volumes, and to which we have already referred,—the ignoring of American surgery and the caricatures of illustrations.

Still, the surgical text is the thing; and in none of the German works is there displayed a more systematic and complete discussion of surgical subjects. It is all eminently practical, and emanates from one of the clearest-minded and most thorough masters of surgery of our time.

JAMES P. WARBASSE.

CUBITUS VARUS; OR, "GUNSTOCK" DEFORMITY FOLLOWING FRACTURE OF THE LOWER END OF THE HUMERUS.[1]

By LEWIS A. STIMSON, M.D.,

OF NEW YORK,

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Fracture of the lower end of the humerus in some of its forms is not infrequently followed, especially in the young, by a conspicuous deformity of the limb known as cubitus varus or "gunstock" deformity. This deformity consists in marked permanent adduction of the forearm, which, of course, is most apparent when the elbow is in full extension. It is shown in Fig. 1.

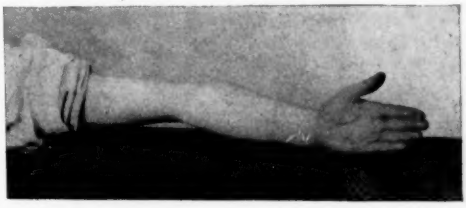


Fig. 1.—Cubitus varus.

Clinically, the most prominent feature is the marked, apparently abrupt, movement made by the forearm towards the ulnar side as the limb approaches full extension, and the peculiarly ungraceful appearance of the limb in this position. Flexion, extension, and rotation are usually normal. The elbow viewed from behind shows the olecranon prominent

[1] Read before the New York Surgical Society, May, 1900.

and slightly displaced towards the inner side, flattening of the inner side of the elbow, and fulness of the outer side on flexion at a right angle with apparent enlargement of the external condyle below and behind.

On palpation, the external condyle appears to be thickened and lowered; the head of the radius rotates against an apparently normal capitellum; the internal epicondyle is less prominent than normal, and the mesial surface of the trochlea shows certain variations from the normal in its relations to the epitrochlea and the olecranon.

The immediate cause is a change in the relations of the transverse axis of the elbow-joint to the longitudinal axis of the humerus, a change by which its normal inclination, looking downward and outward, is changed to one looking downward and inward.

The question that most concerns us is the cause of this change in the direction of the transverse axis.

It has generally been attributed to an ascent of the internal condyle after its fracture, or, and less frequently, to a descent of the external condyle after its fracture. I am fortunately able to present several specimens and skiagrams which throw light upon the subject and indicate that the more frequent cause is probably supplied by other forms of injury which have only recently been associated with the deformity.

Before they are described, it must be noted that specimens showing the deformity due to undoubted fracture and ascent of the internal condyle (heretofore deemed, as I have said, almost the exclusive cause) are almost unknown.

The first specimen is one of low oblique fracture of the shaft without history (Fig. 2). The fracture evidently ran from the outer side at the junction of the lower and middle thirds downward and inward, probably terminating just above the internal epicondyle, and the fragment has united with an angular displacement, by which its upper end is carried half an inch away from the shaft, and the lowest part of the capitellum is brought down to the level of the lowest part of the inner edge of the trochlea; the fragment evidently turning



FIG. 2.—Cubitus varus.



FIG. 4.—Cubitus varus.



FIG. 5.—Cubitus varus.

on its lower inner part as a pivot without other displacement on that side.

The second specimen, also without history (Fig. 3), shows a very marked deviation of the entire lower part of the bone; its transverse axis being so inclined that the lower part of the articular surface looks downward and inward at an angle of about forty-five degrees. The articular surface and the supracondylar ridges show no irregularity; but a fulness above the coronoid fossa strongly suggests a supracondyloid fracture with angular displacement (the angle open inward) of the fragment. The smoothness of the surface and the absence of marked irregularities could be explained, supposing the theory of the fracture to be correct, by its occurrence at an early age, the preservation of much of the encircling periosteum untorn, and the gradual obliteration by absorption of irregularities present at an early time.

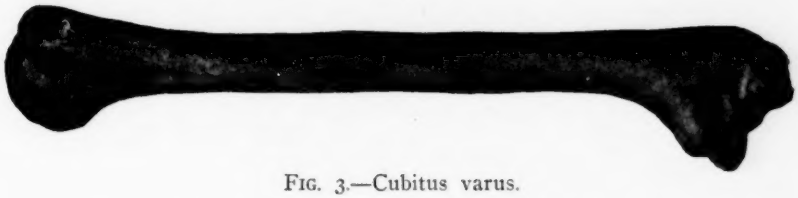


FIG. 3.—Cubitus varus.

The third specimen (Fig. 4) shows a displacement practically identical with that of the second. The internal epicondyle and its ridge are apparently normal; the outer condyle is greatly lowered, the supinator ridge is lost, and the bone beneath is thickened and bent in an antero-posterior curve extending from well above the level of the coronoid fossa to the epicondyle, its convexity backward and its centre projecting so far behind the line of the shaft that the capitellum lies in that line instead of being far in front of it. The articular surface is smooth and unbroken except for a narrow notch between the capitellum and trochlea, which, however, is unaccompanied by any change in the relations of those two parts, but the trochlea is slightly deformed on the inner side, its edge being inclined inward instead of being vertical, and its central

groove is directed towards the outer side of the coronoid fossa. The appearance is as if the trochlea, with the external condyle, had been twisted upon the internal condyle, with lowering of the outer portion, so as to look downward and inward.

The specimen has been sawn twice in a frontal plane, the sections reaching the posterior surface of the bone at their upper end, and the surfaces of section (Fig. 4) show no trace of fracture. But it seems plain that the bone was broken on the outer side above the epicondyle, probably along the epiphyseal line at an early age.

The fourth specimen is shown by two skiagrams (Figs. 5 and 6). The patient, seven years old, injured the elbow by a fall from a pony. The injury was supposed to be a dislocation, and the limb was incased in plaster of Paris for three or four weeks. Two months later the skin over the external condyle became ulcerated by the pressure of the underlying bone, and the latter was freely cut away. I saw the case at that time in consultation. It was evident there had been a fracture passing close above the capitellum, and that the fragment had been displaced inward. The extent and direction of the line of fracture on the inner side could not then be determined.

The skiagrams were taken about three years later. They show detachment and depression of the capitellum, with preservation of its relations with the trochlea, and a twisting of the latter similar to that of the third specimen and a notable thickening posteriorly on the outer side similar to that of the same specimen of the skiagram of the next case. In examining the pictures it must be remembered that the outer portion of the external condyle has been removed.

Another skiagram, Case 5 (Fig. 7), shows the bones in the limb which furnished the photograph for Fig. 1. It was taken from a man twenty-eight years old, who had received his injury at the age of eight to ten years. The condition seems to be very similar to that of the third specimen. There is the same inclination of the unbroken articular surface; the same twist of the side of the trochlea towards its epicondyle; the same elongation of the outer side, and the same thick, bony

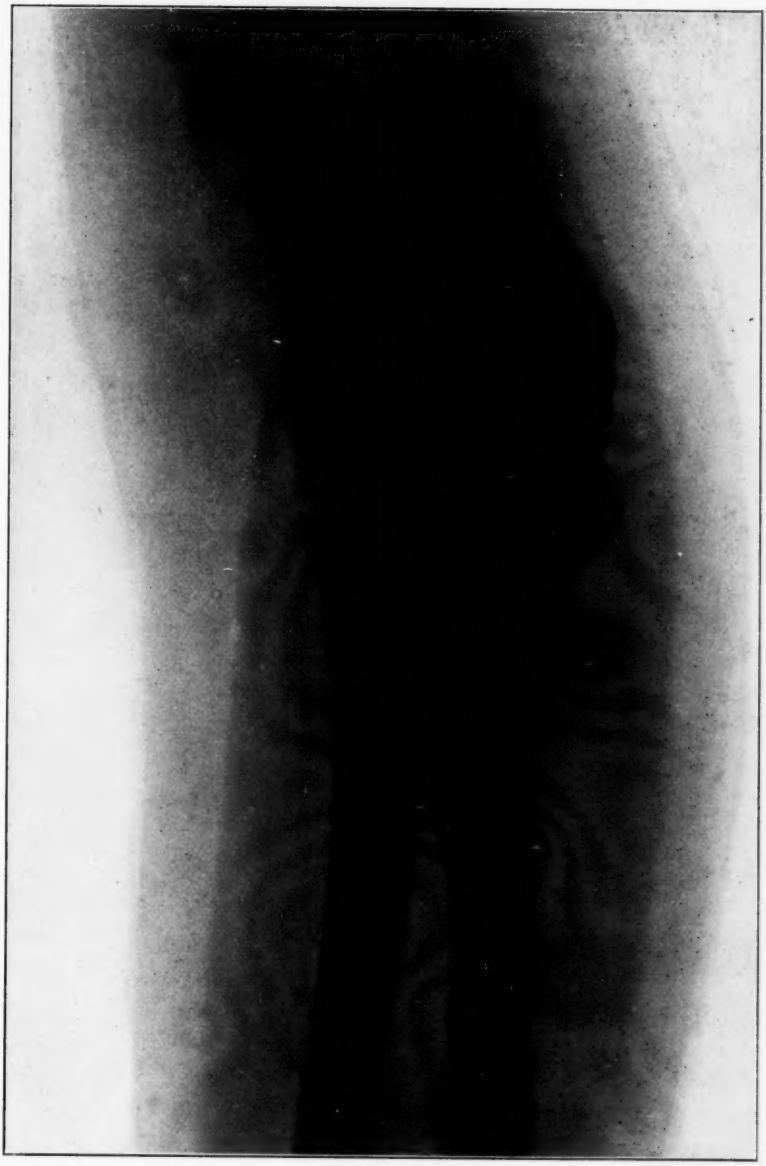


FIG. 6.—Cubitus varus.

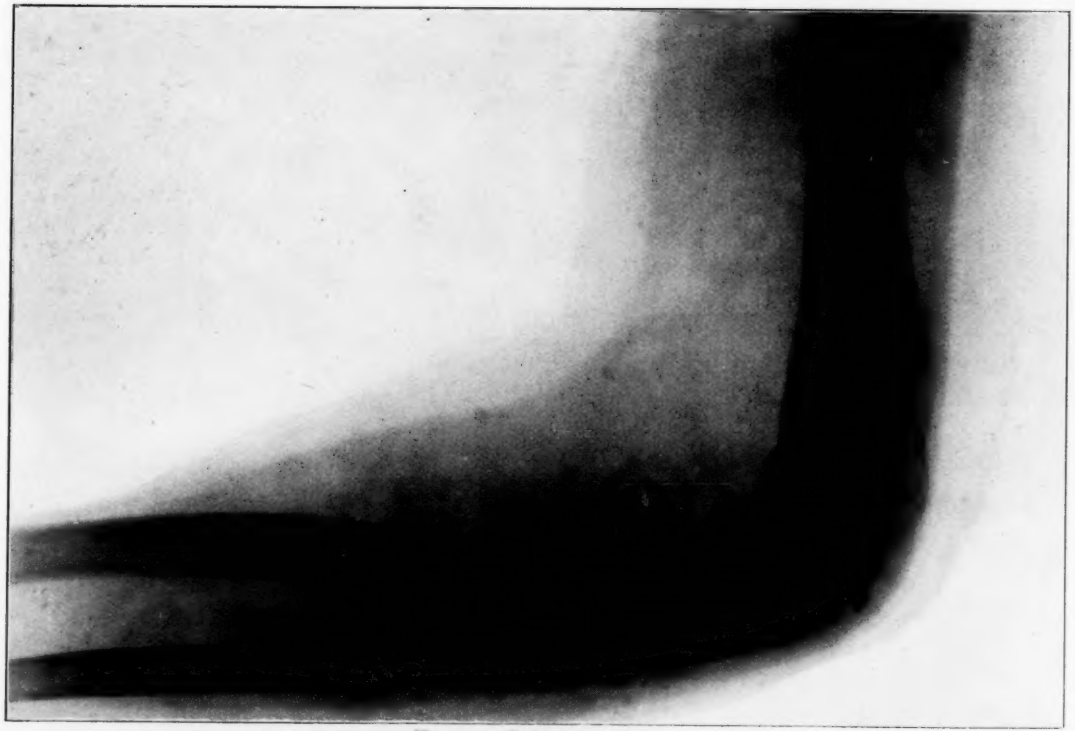


FIG. 7.—Cubitus varus.

column running down to the external condyle, so far as can be judged from the pictures.

Another skiagram, of a case without history (6), shows similar conditions.

In all of these joints one point stands out prominently,—the unbroken line of the articular surface. That proves that the line of fracture did not extend through it; that the cause of the deviation of the axis of the joint is not the independent ascent of the internal condyle or descent of the external, but a twist of the entire articular process, independent of the internal epicondyle in some of them, including it in the others. In some of them, most of them, the entire external portion of the epiphysis, including its epicondyle, is notably depressed with a considerable development of new bone between it and the shaft from which it has been broken away; and in two (Specimen 3 and Case 5, skiagram) this new bone appears as a well-marked, rounded, slightly curved column on the exterior outer aspect of the bone.

It seems probable that the line of fracture in all of the cases passed above the external epicondyle, in one of them to have crossed the bone well above both epicondyles, in the others to have ended on the inner side at or near the lowest part of the internal epicondyle. In two cases (4 and 5) it appears to have detached the epiphysis in its entirety, with the exception of the internal epicondyle, and in one of them (4) with displacement inward.

Another point is that the displacement in all is angular, pivoting on the inner side just above or just below the internal epicondyle. It must be either primary—the result of, and indicating the direction of, the fracturing violence—or secondary, and the result of forces acting during repair.

In the absence of specimens of fresh injury, I have made a number of experiments upon young cadavers. In all the fracture was produced by forcible adduction of the extended forearm, a movement which should produce the angular displacement above mentioned. Two forms of fracture resulted. One was a pure supracondyloid wholly within the shaft; in the

other the line of fracture began on the outer side at or close above the junction of the shaft and epiphysis and passed inward, following the line of that junction wholly or in great part, but sometimes stopping before the inner surface of the bone was reached. In all the periosteum remained in great part untorn, although the adduction was carried nearly to ninety degrees; and in the lower fractures—the second form—the capitellum could be depressed as far as it is in the specimens and skiagrams, and yet retain a periosteal connection with the shaft that was wholly unbroken behind and on the side. Such conditions in the living, if the displacement was maintained, seem suitable for the production of the mass of new bone found in most of the cases shown. In the first form—the supracondyloid—the angular displacement was mainly produced by crushing on the inner side, sometimes without laceration of the periosteum at any point. That would probably insure in the living the smooth surface and unbroken outline of the second specimen, and tends to confirm the opinion that in it the fracture was supracondyloid. Therefore, while admitting that it is impossible to secure in an experiment upon the cadaver the cooperation of all the factors that may take part in the production of a fracture in the living, we can yet assume upon the findings of these experiments that a fracture can be produced in the young, along the indicated lines, which will produce primary displacement which, if not corrected, should result in the deformity of cubitus varus, as observed.

It remains to be ascertained if, in default of this primary displacement or after its correction, agencies may operate to bring about the same result. In the fourth case the patient was examined under ether by an experienced surgeon; the recognized displacement was thought to be a dislocation, and the limb was incased in plaster of Paris. When the dressing was removed about a month later the displacement was present, and was so marked that the skin over the lower part of the supinator ridge ulcerated under the pressure, and the bone protruded. It may fairly be assumed, I think, that the dis-

placement was corrected, but recurred either during the application of the dressing or subsequently. The only agency which could thus produce it is, I think, the unsupported weight of the limb. It is conceivable that the upper part of the forearm, being closely attached to the humerus only at its inner side, should tend to sink on its outer side by its weight alone, and thus draw down the outer part of the fragment while the patient was erect. And in supracondyloid fracture, if the limb was snugly supported by a sling under the elbow, the pressure of the support would be exerted through the olecranon and the internal condyle to push the latter upward, and thus effect the same change in the direction of the transverse axis of the joint.

I cannot escape the conclusion that such close resemblances in a chance collection of six cases, their easy experimental reproduction, and the almost total absence of specimens showing lesions of another kind, justify the belief that the common anatomical cause of cubitus varus is not ascent of the internal or descent of the external condyle after fracture extending into the joint, but that, on the contrary, it is an angular displacement of the entire lower end of the bone after a supracondyloid fracture, or of its lower portion after a fracture which is practically a partial separation of the cartilaginous epiphysis, especially at its outer side. The latter form of fracture seems to be possible only at an early age, not over ten or twelve years, because of the marked relative diminution in the size of the epiphysis as age increases. The epiphysis, which in the infant is a broad, thick, almost cylindrical mass of cartilage extending above both epicondyles and showing hardly a trace of the deep modelling of the articular surface seen in the adult, and giving attachment to ligaments and muscles by which a detaching strain can be exerted upon it through the forearm, gradually becomes relatively small and thin, until it is constituted on the outer side mainly by the projecting capitellum, and in its trochlear portion by a curved scale capping the rounded diaphysis, which not only offers no

purchase to a fracturing force, but can hardly be removed entire by knife or chisel.

Recognition of the displacement ought to be easy by attention to the level of the external epicondyle and head of the radius as compared with that of the internal epicondyle. Error might arise through mistaking the lower end of the supinator ridge for the external epicondyle, but it could be avoided by seeking the head of the radius and the adjoining edge of the capitellum. Comparison of skiagrams of profile views of displaced and normal bones brings out very clearly this lowering of the head of the radius.

Correction of the displacement could probably be easily made by pressure upward and outward against the olecranon in rectangular flexion of the joint, or abduction of the fully extended forearm, and maintenance of the latter position for a week or two would probably be the surest means of preventing recurrence, but it should be combined with confinement to the bed. I do not think full flexion of the joint, which has been recommended of late for the treatment of all forms of fracture in this region, could be trusted to correct the displacement or prevent recurrence, because, in all patients with the deformity whom I have seen, free flexion of the joint was possible. As the deformity does not prevent the attitude, the attitude cannot prevent the deformity.

If the convenient attitude of flexion at a right angle is chosen, and especially if the fracture is supracondyloid, pressure upward against the olecranon by a supporting sling must be carefully avoided, because such pressure would be transmitted to the inner half of the fragment, and would tend to produce the deviation which we seek to avoid. The sling should take the weight of the limb at the wrist.

In the other, the lower and, I believe, the common form of fracture, the rectangular position might be safely taken if incasement in plaster of Paris was used, and the upper portion of the dressing carried over the top of the shoulder so as to prevent its descent, which would permit, or perhaps even produce, recurrence of the displacement.

THE RESULTS OF CASTRATION AND VASECTOMY IN HYPERTROPHY OF THE PROSTATE GLAND.[1]

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In an address on "The Present Position of the Surgery of the Hypertrophied Prostate," before the American Surgical Association in 1893, J. William White detailed a series of experiments which proved conclusively that the removal of the testes in dogs was invariably followed by a shrinkage of the normal prostate. He also collected the observations of a number of writers which showed the same result in the case of certain animals, *e.g.*, the pig, bullock, sheep, and horse. Evidence was also cited that the prostates of eunuchs, and of those who had been subjected to castration for various reasons, were very much below the normal average size. These facts, together with certain other considerations that were brought out, among which should especially be mentioned the one that originally led to the experiments referred to, namely, the probable relation of senile hypertrophy of the prostate to uterine myofibromata, induced Dr. White to suggest that castration might be followed by atrophy of the hypertrophied prostate similar to that which had been observed in the normal gland, and for the same reasons which brought about a disappearance of uterine fibromata after oöphorectomy.

[1] Presented before the American Association of Genito-Urinary Surgeons, Washington, D. C., May, 1900.

The paper attracted attention at once, and surgeons all over the world soon began to report cases in which the suggestion was put into practice.

Two years later, in a paper entitled, "The Results of Double Castration in Hypertrophy of the Prostate," read before the same body, Dr. White collected 111 examples of this operation. Many of these cases were recorded in great detail by competent observers. The results of this investigation will no doubt be recalled by the majority of surgeons. In brief, they showed that in a little more than 87 per cent. of the cases more or less rapid atrophy of the prostate followed the operation; that in 52 per cent. of the cases the accompanying cystitis was either cured or much improved; that more or less return of vesical contractility occurred in 66 per cent.; that the most troublesome symptoms were ameliorated in 83 per cent., and the local conditions became nearly normal in more than 46 per cent. Including every case that had died at the time of making the report, the mortality in this series was 18 per cent. A study of this list showed that in several of the cases the operation could not have been the cause of the fatal issue, so that it was considered only fair to exclude these. This left a mortality of 7 per cent. as the estimated death-rate of the operation *per se*.

A brief summary was also added on vasectomy, ligation, and section of the entire cord, etc.

In 1896, P. Bruns, of Tübingen, analyzed 148 cases of this operation. Inasmuch as these are not described in his paper, it is impossible to tell how many of them are included in the other table. His cases were obtained from the following sources: America, 74; England, 33; Germany, 21; Sweden and Norway, 12; France and Russia together, 4, and the author adds 4 of his own. But 93 of these were recorded with sufficient detail to admit of study. Of these the prostate decreased in size after the operation in seventy-seven instances (83 per cent.). These cases also showed, according to Bruns, "that the aggravated cystitis so often met with is improved in many instances, and in some cases entirely cured." In the matter of vesical contractility, the same writer states, "Of 28

cases in which the catheter was used for from some months to two years, natural voluntary micturition was restored in 22 (78.5 per cent.)." Again, "Of 20 cases in which the catheter life had lasted from 2 to 20 years, 8 have been enabled by the operation to discard the catheter entirely, spontaneous micturition having been restored."

In 1896, A. T. Cabot read a paper entitled, "The Question of Castration for Enlarged Prostate," again before the American Surgical Association. Dr. Cabot tabulated 99 cases which were not included in Dr. White's collection. Of these 18 were not described with sufficient detail to enable one to form an opinion as to the results. Sixty-one cases remained, therefore, for analysis. Dr. Cabot says, "We find that these cases show 9.8 per cent. failure, 6.6 per cent. moderate improvement, and 83.6 per cent. of substantial or very great improvement." The mortality in Dr. Cabot's series is 19.4 per cent., including all cases.

It is not the purpose of the present paper to discuss the theories which have been suggested in explanation of the improvement that follows castration in these cases, nor to compare this operation with the various other procedures which have been recommended and carried out from time to time for prostatic hypertrophy, as these have been done so recently and so fully. The present writer wishes simply to bring together the cases reported which have not been included in the tables of White and Cabot, and to briefly state the results which they show. Unfortunately, a large number of the cases are so imperfectly reported that they do not admit of a detailed analysis. I have made an effort to supply the deficiencies by addressing letters to the various operators, but with moderate success only. In some instances those addressed were too busy to hunt up the records, a fact which I am sure I fully appreciate; in other cases the records had been mislaid, and frequently the patient passed from observation as soon as he was able after the operation.

A glance at the present literature shows that surgeons are by no means a unit in regard to any one point relative to the causes and treatment of hypertrophied prostate. If any

unanimity of opinion is to come out of the present diversified views, it must be through the careful study of large numbers of accurately recorded cases. I realize that this statement is trite to the last degree, but I think its repetition is warranted. If each operator would preserve records of the important features of every case, say for the next five years, much of the uncertainty which now exists might be cleared up.

An effort has been made to avoid repeating cases reported at different times, and frequently so briefly that their identity is difficult or impossible to establish. Few, if any, are thus repeated; certainly not enough to materially modify these statistics.

Castration.—The cases appended hereto include 159 examples of castration. Thirteen of the patients died, and in one collection of 16 no statement whatever is made as to the result. Deducting these, 130 remain. Of this number the prostate is said to have decreased in size in 67 (51.5 per cent.). The period at which the reduction in size was noted varies from a few days to a few months. In four instances only is the fact stated that there was no change in the size of the gland (3 per cent.). In one instance, examination after the operation showed that the prostate was larger. If we add to these the cases in which a general improvement in the patient's condition, the relief of cystitis, the return of normal micturition, and other evidences that may be assumed to indicate a decrease in the size of the prostate, we find that somewhat over 90 per cent. may be said to have been benefited. This refers, of course, to those who survived the operation only. It is either stated or implied in 74 instances (57 per cent.) that the function of micturition was improved or wholly restored. In but one instance is it stated that there was no change in this respect. Cystitis was relieved or cured twenty-four times (18.5 per cent.). The length of the urethra diminished in a number of cases, the amount varying from half an inch to two inches. The residual urine was diminished in quantity or disappeared in 32 cases (25 per cent.). In 87 cases (67 per cent.), it is either stated or implied that there was a general improvement in the patient's condition. This occurred sometimes in connec-

tion with a notable change for the better in some of the other features, and sometimes it was the only result noted. In but six instances is it specifically stated that there was no improvement (4.6 per cent.).

In the 159 cases there were 13 deaths, a mortality slightly exceeding 8 per cent. The deaths were as follows: No. 1, sepsis from the pyuria; no autopsy. No. 3, autopsy showed pyelonephritis. No. 11, surgical kidneys. The author says, "He should not have been operated upon." No. 14, suppression of urine fourth day. No. 31, asthenia. No. 46, emphysematous phlegmon. No. 50, exhaustion. No. 71, not stated. No. 79, pneumonia. No. 89, exhaustion. No. 118, infection of wounds and secondary deposits; pyelonephritis. No. 157, weakness. No. 158, hiccough and exhaustion. No. 159, exhaustion.

Even in the fatal cases an improvement was frequently observed. In Case 1 the reporter says, "Improvement noted during ensuing week (after castration). There was rapid subsidence of the prostate; it was reduced more than one-half." Case 3 had been entirely dependent upon the catheter for three months. On the eighth day after castration, urine was passed spontaneously. On the fourteenth day the prostate was found to have decreased in size. Death occurred on the twenty-second day after operation. Case 11 did not react well after the operation, but the catheter withdrew urine at nine inches, whereas, before the operation, urine was not drawn at less than ten inches. In Case 31 it appears that improvement was observed on the third day after castration. Urination was less frequent, the pain was greatly relieved, the residual urine diminished, and spontaneous micturition returned in five days. There was marked decrease in the size of the prostate. The patient, who was in very feeble health before the operation, gradually failed. Of Case 71 the reporter says, "The urinary symptoms and general condition had at one time sufficiently improved to hold out hopes of recovery, but he succumbed at the end of a few weeks, showing no decrease in the size of the prostate. Case 118 had been unable to pass a drop of urine without a catheter for months. There was a purulent catheter

urethritis and the kidneys were diseased. On the third day after castration the urine was passed in drops. Two-and-a-half days later several ounces were passed voluntarily. At the end of ten days the operative results were satisfactory, but death occurred in five to six weeks from infection of the wounds and secondary deposits. The autopsy showed pyelonephritis. In both Cases 157 and 158 there was some evidence of improvement before the fatal issue. The reduction in the mortality is due no doubt to a more careful selection of cases and to greater discretion in recommending the operation. It will be observed that in a considerable number of fatal cases the kidneys were infected as the result of the prostatic enlargement, and the former condition would usually have been prevented by proper treatment of the latter at the right time.

A few instances of mental disturbance are reported. Case 4 exhibited a mild delirium for a time, from which he fully recovered. Case 12 suffered from active delirium during convalescence, but fully recovered. Case 14 had subdelirium. Case 15 became melancholic, but improved under the administration of fresh sheep's testes. Case 52 suffered from mania, which, however, entirely passed off. Case 141 was said to have some cerebral trouble.

On the other hand, it is to be noted that in some instances the mental and physical vigor of the patient was distinctly improved as a result of the operation. Of the unusual symptoms may be mentioned polyuria in two cases (No. 8 and No. 9); both patients recovered. Case 104 suffered from " hot flashes" after the operation. Case 105 had marked ptyalism after the operation. The operator, Dr. Howard Lilienthal, refers to the possible connection between the action of the parotid and that of the testes, and refers to the metastatis sometimes observed in mumps.

No case of change in the voice, " femininity," or alteration of the disposition,—conditions which certain authors have cited on theoretical grounds, as objections to the operation,—is mentioned in this series.

Vasectomy.—The list of vasectomies for enlarged prostate comprise 193 cases. The details of most of these are not

as full as those of castration, so that the deductions are not as satisfactory. In but 17 instances is it noted that the prostate diminished in size (over 9 per cent.). There was an improvement in the function of urination in 27 cases (15 per cent.). In 11 cases the cystitis was relieved or cured (over 6 per cent.). Residual urine diminished or disappeared in 9 cases (5 per cent.). The explanation of this rather poor showing is that so many of the cases are reported in general terms instead of in detail. In 118 cases (67 per cent.) the changes following the operation, although variously described, have been classed under the head of general improvement.[1] In 27 cases (15 per cent.) it is distinctly stated that no improvement followed the operation. There were 13 deaths (6.7 per cent.). Case 16, the autopsy showed that the prostate was simply a bag of pus. The middle lobe of the prostate was soft and pendulous. The left ureter was the size of a forefinger. There was little or no renal tissue in the left kidney, which was merely a bag of pus. No. 110 died of surgical kidneys. No. 114 and No. 116 died of uræmia. No. 161 died from general weakness. No. 175 was supposed to have carcinoma of the prostate. No. 178, autopsy showed carcinoma of the prostate, secondary deposits, brown atrophy of the heart, and chronic nephritis.

Some mental disturbance was observed in a few instances. In this respect the two operations are about on the same footing. Vasectomy has been successfully performed for the relief of the recurring painful orchitis. This condition quite justifies the operation, apart from any intention to affect the prostate.

I have purposely omitted the cases in which castration and vasectomy have been combined with other operations, such as litholapaxy and suprapubic drainage, inasmuch as these fac-

[1] The most valuable evidence upon the subject of vasectomy is furnished by the papers of Mr. Reginald Harrison, in *The Lancet*, London, May 5 and July 14, 1900. His experience embraces over one hundred cases. He has been able to observe benefit of some kind and in some degree in almost every case, although the accompanying conditions often prevented anything like a cure.

tors of necessity modified the results of the single operation. A few cases have been included in which the primary operation of castration or vasectomy has been performed, either for the purpose of inducing atrophy of the prostate preparatory to litholapaxy, or in which the stone was first found after the gland had shrunken.

The figures here set forth furnish, in the opinion of the writer, ample reason for advising and performing one of these operations in suitable cases. The conditions which may be considered appropriate for these procedures and the choice between them have been fully set forth elsewhere, and need not be repeated here.

CASTRATION.

(1) Abbe, R. (Proceedings of American Surgical Association, May, 1896). Prostate much enlarged, hard. Patient in catheter stage, pyuria.

Castration, 1894. Improvement noted during ensuing week. There was rapid subsidence of the prostate. It was reduced more than one-half. The patient became septic from the pyuria and died. An autopsy was not allowed.

(2) Bereskin (*Medicinskoe obosvenie,* January, 1896). Missionary, aged eighty-one years; symptoms of prostatic trouble for fifteen years; catheter has been employed for ten years. At the time of the report it was used every three hours during the day and every two hours at night. There was marked cystitis, the urine was alkaline, and contained pus and blood. The limits of the prostate could not be felt.

Castration. At the end of three months the prostate was found to be distinctly decreased in size. A No. 18 catheter could now be passed, while previously nothing larger than 14 could be introduced. A stone was discovered at this time, which was removed by suprapubic cystotomy. The wound healed in two months. The patient was still obliged to use the catheter, but only half as frequently as before, and was able to pass a No. 22 with ease. The urine was acid and clear. Prostate was markedly decreased in size.

(3) Ibid. Patient aged sixty-one years. Frequent urination for one year. Entirely dependent upon catheter for three months. Urine was alkaline, foul, and bloody. Patient was getting thin and weak. He had some fever. Prostate moderately enlarged, especially the right half. Potentia cœundi remained.

Castration. On the eighth day the patient passed urine spontaneously. On the fourteenth day prostate was found to have decreased in size. Death occurred on the twenty-second day after operation. The autopsy showed pyelonephritis, to which condition the death was ascribed.

(4) Borelius (*Centralb. f. Chir.,* No. 21, 1896). Patient aged seventy-

six years. First evidence of prostatic trouble in the summer of 1894. Complete retention in August. Later, the patient was obliged to pass urine every hour. At the time of coming under observation, the bladder was distended to the umbilicus; prostate was greatly enlarged; the upper edge could barely be reached.

Castration, January 3, 1896. On the third day the patient was much improved. Prostate had decreased in size and urine was passed more freely. The patient exhibited a mild delirium for a time, but this passed off.

(5) Bosquet, M. H. (*Gaz. Heb. de Méd. et de Chir.*, No. 95, 1896). The patient, aged sixty-six years, had retention of urine, and catheterism was very difficult. Prostate was enlarged, especially the middle portion.

Castration. The prostate underwent rapid atrophy, but the function of the bladder was re-established very slowly.

(6) Brownfield, H. M. (*British Medical Journal*, March 15, 1896). Patient, aged sixty-nine years, had complained for three or four years of prostatic symptoms. There was complete retention, for which suprapubic aspiration was performed and a tube was inserted.

Castration, May 27, 1895. On the third day the patient passed a small quantity of urine naturally. On June 24, catheter was discarded entirely. Nine months after the operation there was no difficulty in emptying the bladder. The patient was more comfortable than he had been for years. He was able to sleep five to six hours at night.

(7) Bruns, P. (*Mittheilungen aus den Grenzgebieten der Med. und der Chir.*). Patient, aged seventy-six, complained for eight or nine years. Frequent urination, pain, cystitis, hæmaturia; had employed the catheter for eight weeks.

Castration, November 9, 1895. On the second day the catheter passed more easily. Sixty hours after operation urine was passed spontaneously. The catheter was dispensed with on the eighth day. Prostate was moderately reduced, but the cystitis was not greatly benefited. Patient was well satisfied with the results. Spermatozoa in both testes.

(8) Ibid. Patient, aged seventy-five years, complained of prostatic symptoms for ten years. There was marked cystitis; catheter had been used for six years. Two years before the time of the report, putrid cystitis developed, for which suprapubic drainage was established. Permanent fistula resulted. In spite of irrigations, the patient's condition grew worse. The prostate was the size of an orange.

Castration, September 25, 1895. On the eighth day pains were distinctly less; on the twelfth day the prostate was found to be a little smaller. The cystitis constantly improved. Urine became clear. Three weeks after operation, a polyuria developed, the quantity reaching as high as three litres. Capacity of the bladder before operation 150 cubic centimetres, at the time of the report it was 300 cubic centimetres. Spontaneous urination, which had been absent for six years, did not return, but the patient was free from pain and happy with the result of the operation. Both testes contained spermatozoa.

(9) Ibid. The patient, aged sixty-five years, had symptoms of pros-

tatic trouble for eight years. There was marked cystitis, micturition fifteen times daily; catheter used daily for three years, in addition. Prostate much enlarged, hard, and uniform.

Castration, November 5, 1895. On the fifth day urine was passed in a stream without difficulty. On the seventh day a decided decrease in the size of the prostate was noted. Fourteenth day marked polyuria, 1700 to 2400 cubic centimetres daily. Urine as colorless as water. After four weeks the quantity was again normal. Six weeks after operation there was no further need for the catheter. Catarrh of the bladder had disappeared. Prostate was considerably reduced in size. Patient regained his strength and resumed business.

(10) Ibid. Patient, aged sixty-two years, had complained for two years; marked catarrh of bladder, desire to urinate every half hour; the catheter had been employed for six months. Prostate nearly the size of a goose's egg, hard.

Castration, June 14, 1895. Fifth day could pass urine spontaneously and with little trouble. At the end of seven days the urine was passed naturally. Prostate considerably smaller. Fourteen days, prostate size of a hen's egg; urine passed naturally every two or three hours. At the end of six months the patient remained well. He has not used the catheter since operation. Urine is passed at long intervals. Residual urine only a few drops. The vesical catarrh not entirely gone.

(11) Cameron, I. H. (*Canadian Medical Review*, January, 1897). Patient, aged seventy, had retention of urine and cystitis from prostatic enlargement. The catheter withdrew urine at ten inches.

Castration. The patient did not react well. The catheter withdrew urine at nine inches. Patient died (time not given). Autopsy showed surgical kidneys. The author says, "He should not have been operated upon."

(12) Ibid. Patient, aged eighty-one years, suffered a long time from febrile disturbance due to chronic cystitis caused by enlarged prostate.

Castration was followed by prompt and decided improvement. Patient had rather active delirium during convalescence, but this disappeared.

(13) Ibid. Patient aged sixty-seven years, retention from prostatic enlargement for six weeks.

Castration. The patient could pass urine within three or four days. "Complete recovery."

(14-26) Cameron, I. H. (*British Medical Journal*, October 10, 1897). Castration, sixteen cases; three reported in detail above. One died on the fourth day from suppression of urine. Two exhibited some mental symptoms. One, aged eighty, had subdelirium, and second, sixty-seven, became melancholic, but was improved by feeding the fresh testes of the sheep. One delirium, melancholia.

(27) Charlton, F., Indianapolis, Ind. Patient, aged seventy-seven years, complained of pain and hypogastric tenderness. The urine contained blood and phosphates. There was free hæmorrhage at times. The catheter had been employed for eight years, and at the time of the report was used

every twenty minutes or half hour. Prostate was the size of a tangerine orange. Potentia cœundi absent for five years.

Castration, July 15, 1895. At the end of ten days the catheter was dispensed with. October 15 the patient goes four to five hours without passing urine, which is voided in a full stream and is perfectly clear. The patient has gained fourteen pounds in weight. The prostate is one-third the size it was before the operation.

(28) Chetwood, Charles H. (*Journal of Cutaneous and Genito-Urinary Diseases,* March, 1897). Man, aged eighty-one years, had prostatic trouble for eight or ten years. There had been several attacks of retention relieved by the catheter. The catheter was used habitually for four years. Before operation, the urine was voided every hour in the day and the catheter used twice at night. Irrigation to the bladder, steel sounds, salol, and oil of gaultheria did not improve the condition.

Castration, October 8, 1896. Two weeks later the prostate was reduced one-third and was softer. Residual urine reduced one-third, and the urethral length one-half inch. At the last examination the urine was passed every two hours during the day. Residual urine, one to four ounces. Prostate was reduced fully one-half and the urethral length three-fourths to one inch. There was no pain during micturition.

(29) Chevalier (*Gaz. Heb. de Méd. et de Chir.,* November 19, 1896). Man, aged fifty-nine years, prostatism for ten years. He had three attacks of complete retention, the first three years before the time of report. He had been subjected to nearly all forms of palliative treatment. Cystotomy was performed for the third attack of retention, with only temporary relief. Vasectomy failed to give any relief.

Castration enabled the patient to pass urine naturally again.

(30) Clado (*Gaz. Heb. de Méd. et de Chir.,* November 19, 1896). Man, aged sixty-two, requested the operation of castration on account of vesical pain. The catheter passed easily. There was no improvement from the operation. The condition was thought to be carcinoma of the prostate.

(31) Dillard, John W., Lynchburg, Va. (Personal communication.) G. T., aged about seventy years; mechanic; symptoms of prostatic trouble for a long time; constant dribbling of urine both day and night, with great pain and a large amount of residual urine; retention complete; catheterization was done with difficulty; there was also cystitis. Prostate was quite large. The bladder was examined for stone, but none found; his general health was very feeble and the mental condition not good; sexual power lost. Patient had been treated both medically and surgically, but without success.

Castration, January 15, 1898. On the third day the conditions commenced to improve; urination was less frequent; there was great relief from pain; less residual urine, and spontaneous urination returned in five days; marked decrease in the size of the prostate, but the general and mental condition was very poor. The patient, being greatly debilitated, died February 15, 1898, from asthenia.

(32) Ibid. (Personal communication.) S. H. M., aged sixty-five,

editor. Prostatic trouble first appeared three years prior to report; urinating every hour both day and night; slight pain; he was obliged to use the catheter, which was passed with great difficulty; marked cystitis and very great hæmaturia after instrumentation. The prostate was as large as a good-sized lemon. Patient previously has been tapped over pubis because of inability of surgeon to pass the catheter.

Castration, September 20, 1897. Marked improvement at the end of five days; less frequency of urination and great relief of pain, with great decrease in amount of residual urine. Spontaneous urination returned in one week; cystitis disappeared in about two weeks; hæmaturia in one week. Prostate greatly decreased in size and the general health good. Convalescing October 15, 1897, and patient entirely well April 15, 1898.

(33) Ibid. Ed. B., aged fifty-five, blacksmith. Urine was voided every four hours day and night. There was a little pain and some residual urine; catheter passed easily; symptoms of cystitis were present; the prostate was about three times the normal size.

Castration, March 1, 1893. At the end of the sixth day there was a marked diminution in the frequency of urination, but little pain and a decrease in the amount of residual urine; cystitis disappeared in two weeks, and the prostate was very much decreased in size. General and mental conditions greatly improved. Convalescence within a month, and entirely well August, 1893.

(34) Doughty, Francis. (Personal communication, December 2, 1896.) Patient, aged sixty-two years, suffered from enlargement of the prostate and cystitis. Finally, acute retention followed, and later the power of voluntary urination.

Castration, May 26, 1896. Patient has not used the catheter since operation. Urine is passed with considerable freedom. Examination by rectum reveals scarcely any prostate at all.

(35) Ekehorn, G. (*Hygeia,* Vol. xiii, No. 8, 1896, page 1481). Man, aged sixty-two years, had complete retention with few other symptoms. Residual urine about 500 grammes.

Castration, normal recovery. Residual urine reduced to seventy-five grammes. The prostate not much reduced.

(36) Ibid. Patient, sixty-eight years of age, had cystitis and strangury for several years, and finally complete retention. Prostate was enlarged mainly from side to side and very hard.

Castration. Sixteen days later the patient began to pass urine spontaneously. On leaving the hospital residual urine was 125 grammes.

(37) Ibid. Man, aged seventy years, had symptoms of enlarged prostate for many years. For six months a cystitis existed which had resisted two months' treatment in the hospital.

Castration, perfect recovery.

(38) Ibid. Man, aged seventy-three years, had enlargement of the prostate with cystitis, the lateral lobes chiefly affected. Marked arteriosclerosis.

Castration. Spontaneous partial evacuation of the bladder, about 500

grammes in twenty-four hours; catheter had to be continued. Residual urine 500 grammes.

(39) Euren, Axel (*Upsala Lakareforenings Forhandlingar.* Forsta Bandet. Andra Häftet, December 23, 1895). Patient aged seventy-eight; symptoms of prostatic trouble several years; uniform enlargement of the prostate; total retention for one and a half weeks.

Castration, November, 1895. On the third day the patient was able to completely empty bladder naturally. On the sixth day a decided decrease in the size of the prostate was noted.

(40) Ibid. Patient aged seventy-eight years. Prostatic trouble for many years. There was marked cystitis and the urine was bloody. Prostate very much enlarged.

Castration, November 5, 1895. On the fourth day urination was less frequent and there was less residual urine. Prostate became smaller and softer.

(41) Ibid. Patient aged seventy-one years. Symptoms of prostatic trouble for eight or ten years. There was severe cystitis. The urine was muddy and loaded with epithelial *débris.* Catheter was required twice daily. The finger could not reach the upper end of the prostate.

Castration, September 2, 1895. On the second day the amount of residual urine was less, and it further gradually decreased, and with it the other symptoms. The right testis was removed under local cocaine anæsthesia without relief. Ten days later the left testis was removed. Examination two months later showed that the prostate had uniformly decreased in size and was softer in consistence.

(42) Ibid. Patient, aged seventy-seven years, pale, thin, nervous, worn out. Symptoms of prostatic trouble for some years. Mild cystitis. Residual urine 150 to 200 cubic centimetres. Catheter was required three times daily. The upper border of the prostate could scarcely be reached by the finger.

Castration, April 19, 1895. On the fourth day the residual urine was 50 cubic centimetres. The patient looked fresher and younger, and gained in weight. The residual urine remained at about 50 cubic centimetres eight months after the operation, but the patient was sufficiently improved to resume his work.

(43) Ibid. Patient, aged sixty-five years, had complained of prostatic trouble for two years. The urine was acid and muddy in appearance. Residual urine 400 cubic centimetres. The prostate was hard and uniformly enlarged. The upper border could not be reached.

Castration, March 20, 1895. On the fourth day urination is reported to be much easier. Patient feels better, and is satisfied with the result of the operation, although he was unable to work. Potentia cœundi remained for six months and then gradually disappeared.

(44) Farrant (*British Medical Journal,* May 16, 1896). Gardener, aged sixty-seven years, had symptoms of prostatic trouble for nineteen years. Residual urine fifteen ounces. There was frequent urination day and night, and the catheter was passed nine inches before drawing urine.

The prostate was three inches in breadth, and the upper border could not be felt.

Castration, February 9, 1896. On the fifth day the frequency of urination was less; on the tenth day all pain had disappeared. The catheter passed easily and drew urine at seven inches. The lateral diameter of the prostate was about one inch, and the latter border was distinctly felt. On March 11 residual urine six to eight ounces. March 21, one ounce; April 14, no residual urine. The patient retires at 8.30, and rises but once during the night. He feels like another man.

(45) Gabrielsen G. (*Nosrk. Mag. f. Laegevidensk,* October, 1896). Man, aged seventy-two, had dysuria for two and a half years. Urinary incontinence three or four times hourly.

Castration. At the end of three weeks the dysuria had disappeared; at the end of five months the prostatic hypertrophy had greatly lessened and urination occurred only two or three times at night.

(46-49) Gerster, Arpad G. (*Brooklyn Medical Journal,* April, 1898). Castration. Four cases, three much benefited. One died of emphysematous phlegmon.

(50) Glenn, W. F. (*Southern Practitioner,* March, 1896). Castration. Death on the eighth day from exhaustion.

(51) Guyon (Reported before French Congress of Urologists, Paris, 1896). Complete retention; cystotomy; after several days a catheter could be introduced, and was allowed to remain for some days. After its removal the former condition occurred. Resection of the vasa deferentia did not relieve the condition.

Castration. The urinary symptoms at once began to improve. A month after the operation the prostate had reduced one-third of its size; the patient passed urine easily, and there was no residual urine.

(52) Handley, J. W. (*Southern Practitioner,* March, 1896). Patient, aged fifty-seven years, had symptoms of prostatism for a long time. There was retention of urine, cystitis, hæmaturia, and general prostration. Prostate was greatly enlarged.

Castration, May 25, 1895. At the end of twenty-four hours the hæmaturia and vesical irritation were relieved. The catheter was discarded; patient could pass urine at will. Before operation the patient rose every hour at night to pass urine. Three days after operation the urine could be retained for three hours. Mania developed, but gradually improved. The general condition was very much better than before operation.

(53) Harrison, Reginald (*Lancet,* London, December 12, 1896). Patient, aged seventy years, had a recurrence of stone after lithotrity on three different occasions, at intervals of a year or so. On the fourth occasion the urine was so foul and the prostate so large that suprapubic cystotomy was performed and the phosphatic stone removed. The bladder was drained for some time. The fistula finally closed. There was a speedy return of the symptoms of cystitis and stone. The bladder was emptied by litholapaxy and double castration performed. The relief was complete, and has remained permanent now for nearly two years.

(54) Haynes, F. L. (Personal communication.)

Castration. "It bids fair to be a perfect success." Two weeks after operation the patient was thought to have dilated ureters, and perhaps kidneys, also. About this time the patient became comatose, and the secretion of urine was almost suppressed. For three days the recovery seemed impossible. Improvement gradually took place, however, due mainly, apparently, to the use of immense quantities of normal salt solution hypodermically, and by the rectum.

(55-65) Horwitz, Orville (*Brooklyn Medical Journal,* 1898). Eleven cases not included in the tables of White and Cabot. All of the cases recovered from the operation. The relief appeared in from three days to three weeks, the gland being very much smaller by the tenth day after the operation. In four cases stone was detected ten days after the castration, and was successfully removed on the fourteenth day after the first operation.

Of twenty-three cases operated upon by the author, which embraces the sum of his experience, the results in fifteen have been all that could be desired. Improvement began, as a rule, as early as the third or fourth day. At the present time these patients are not employing the catheter; cystitis has disappeared, general health excellent. In six cases general health much improved. Tonicity of the bladder not restored. Employ catheter several times a day. No trouble in the introduction of the instrument. No attacks of retention since the operation. Prostate has undergone atrophy; still slight cystitis. In two cases, very old patients, with damaged kidneys, improvement in general health; still employ the catheter; still considerable cystitis; prostate underwent atrophy; no difficulty in inserting the instrument; bladder in each instance much contracted.

(66) Hunt, Arthur (*Lancet,* London, October 3, 1896). Man, aged seventy-three, had retention in April, 1893; second attack the following November. The prostate had increased in size during this time. The urine was offensive and ammoniacal. February, 1894, orchitis developed on the left side. During this attack the corresponding lobe of the prostate diminished in size, and the catheter passed more easily. Patient's general condition rapidly grew worse.

Castration, March 15, 1895. Three hours later three ounces of urine were passed naturally; during the succeeding five days, forty-two to fifty ounces of urine were passed, then retention recurred. The gland was slightly decreased in size at this time. The stumps were tender and swollen. April 9 voluntary urination returned, and the pain and swelling in the cords subsided six weeks after operation; all the urine was passed naturally and with increasing force. September, 1896, no catheter has been passed for thirteen months; urination normal; atrophy of the prostate appears complete. The urine is acid and free from pus. General health is good. Patient has gained weight.

(67) Jones, Robert (*British Medical Journal,* November 5, 1898, page 1416). Patient, sixty-seven years old, had complained of prostatic trouble for years; frequent urination and residual urine; bladder distended above

the umbilicus; there was complete retention for six weeks; urine alkaline; slight cystitis. Prostate about the size of a "Newtown pippin." Was irritable, restless, and morose; had been treated for three months without improvement.

Castration, April, 1896. Convalesced rapidly, and in 1899 he felt uncommonly well; could retain his urine four hours with little residual urine, and bladder contractibility had fully returned. Patient stated, "I'm a young man, free from pain, strong and active."

(68) Ibid. Man, sixty-five years old, had used the catheter for five years; complete retention frequently and attacks of cystitis often. Prostate about the size of a hen's egg. Sexual power normal, but gladly accepted operation; had double inguinal hernia.

Castration. Spontaneous urination at end of two weeks, and catheter discarded after six weeks; prostate decreased one-half in three months.

(69) Ibid. Patient, seventy-three years old, had suffered for ten years, and used catheter for two years; suffered from cystitis, and urine showed blood. The prostate was very greatly enlarged. Life had become unbearable, and he gladly submitted to operation.

Castration. Patient showed a general improvement within two weeks; residual urine being reduced to one-half. Continued to make good progress until he died five months later of pneumonia.

(70) Ibid. Man, sixty-five years old, boiler-maker, had suffered many years. There was complete retention for three months, and the catheter was passed with great difficulty. Prostate was enormously enlarged. The prostate had been tunnelled during one attack of retention.

Castration. Great shock for twelve hours; spontaneous urination returned in twenty-four hours, and was complete in three weeks, with decrease in residual urine to one-half. In over twelve months since operation patient had but one trivial return.

(71) Ibid. Patient, seventy years of age; urine all residual; suffered with cystitis; prostate size of hen's egg; very feeble; pulse irregular; tongue dry.

Castration. The urinary symptoms and general condition had at one time sufficiently improved to hold out hopes of recovery, but he succumbed at the end of a few weeks, showing no decrease in the size of the prostate.

(72) Kammerer, Fred. (Personal communication.) D. H., aged sixty-eight, merchant. Had suffered for three years, being obliged to urinate every half-hour day and night, seven to ten ounces of residual urine. Urine can be passed only with great exertion; very severe cystitis. Prostate very large. Mental condition good outside of irritability; had been treated with internal remedies and irrigation of bladder for a long time, with no result. Cystoscopic examination showed prostate uniformly enlarged, with no projections of central lobe into the bladder.

Castration, August 14, 1895. Commenced to improve September 15; great relief from pain, slight amount of residual urine, and spontaneously passes urine in small stream. Prostate much smaller and general improvement marked. Beginning of December, residual urine only two ounces; passes water in fair stream every three or four hours.

(73) Kane, H. H. (Personal communication.) Patient, age not given, had the usual symptoms of enlarged prostate. A stone searcher was introduced with great difficulty and a stone was detected.

Castration was performed with the view of facilitating the operation of litholapaxy, by reducing the size of the prostate. The patient was out of bed in a week; the symptoms improved very materially, but the patient returned to work and passed out of the hands of the writer.

(74) Ibid. Patient urinated every hour in the day and suffered from constant desire at night. The urine contained sugar, pus, mucus, and triple phosphates. Prostate enlarged.

Castration for traumatic lesions of the testes. Decided relief in all of the prostatic symptoms. Passed urine every two to two and a half hours in the day, and but once at night if he used the catheter before retiring.

(75) Ibid. Patient was voiding urine every half-hour to hour in the daytime and every fifteen minutes at night. There was marked cystitis. Prostate formed a large projection into the rectum. Patient was much emaciated.

Castration, June, 1895. Relief almost immediate; now passes urine partly by catheter and partly naturally every six to eight hours. Is not obliged to rise at night. A small stone which was present before operation was easily removed by litholapaxy. Nine months later the patient was practically a well man; he had gained fifty-eight pounds.

(76, 77) Keen, W. W. (*The Brooklyn Medical Journal,* April, 1898). Castration. Two cases; results fairly satisfactory.

(78) Kelsey, C. B. (*Medical Record,* New York, May 23, 1896). Patient, aged fifty-nine years, had employed the catheter every three to five hours for two or three months. The prostate was very large, and the patient suffered greatly from cystitis.

Castration. Three weeks after, little, if any, improvement, and perineal section was performed for permanent drainage. Two and a half weeks later the patient died of chronic nephritis. As far as could be seen, death was not in any way hastened by operative interferences. The patient had an inguinal hernia, for which Bassini's operation was done at the time of the castration. Microscopic examination did not show any signs of atrophy of the prostate.

(79-86) King, E. E. (*Canadian Medical Review,* January, 1897).

Castration, eight cases; in one marked improvement was noted in eighteen hours; one died of pneumonia after operation; in six cases the results were so good that Dr. King was well satisfied.

(87) Koenig (*Centralb. f. d. Krankh. d. Harn und Sex. Org.,* October 5, 1895). Patient, aged seventy-eight, had prostatic symptoms for ten years. There was one-half litre residual urine, which was alkaline.

Castration, June 11, 1894. By the middle of July the prostate was smaller; residual urine, 100 cubic centimetres. July 24, 1895, prostate scarcely could be felt; residual urine often less than 50 cubic centimetres.

(88) Korsing (*British Medical Journal,* February 8, 1896). Patient,

aged eighty-five years, had not passed a drop of urine except by artificial means for eleven years.

Castration was performed to facilitate the introduction of the catheter. Two months after the operation the patient could pass urine naturally.

(89-96) Kümmell (*Berliner Klinik*, August, 1895).

Castration, eight cases; considerable relief followed in all. In two the functions of the bladder were restored in spite of considerable weakness of the detrusor. One patient, aged seventy-seven, died from exhaustion four weeks after the operation.

(97) Langton, John (*British Medical Journal*, February, 1899). About 1890, a man, aged sixty-eight, had tuberculous disease of the right testicle and enlarged prostate. He urinated twenty times a night. The right testis was removed. Three or four years later the left testis was tuberculous. The right half of the prostate was then much reduced in size. The left testis was removed, after which the whole prostate became much reduced in size, and now, at the age of eighty-seven, the man passes urine only two or three times at night.

(98) Larue, Felix A. (*New Orleans Medical and Surgical Journal*, November, 1898). C. L., aged seventy-four years; prostatic symptoms only noticed for a month; pain and two pints of residual urine; metal catheter only could be passed. Cystitis. Prostate symmetrically enlarged. He was weak from loss of sleep and appetite. Regular catheterization of bladder and daily aseptic irrigations and general measures for three weeks without benefit.

Castration, June 1, 1896, from which he recovered completely cured; spontaneous urination returned within a month, with disappearance of cystitis and decrease in the size of the prostate; two and a half ounces clear residual urine.

(99) Ibid. X., aged sixty-six, was obliged to urinate twenty-five to forty times a night; residual urine ten to fifteen ounces; catheter was passed with difficulty, prostate being large and hard. General and local treatment for two weeks without success.

Castration, May 11, 1897, from which he recovered promptly; spontaneous urination occurred after the fourth day; prostate decreased in size, and in May, 1898, had not used catheter since August, 1897. General conditions much improved; four ounces residual urine.

(100) Legueu (*Ann. des mal. des Org. Gen.-Urin.*, December, 1895). Patient aged sixty-six; complete retention for six weeks; prostate enormous.

Castration, August 28, 1895. Six hours afterwards spontaneous urination; catheter never required after operation. Hæmaturia ceased four days after the castration. Five months after the operation the patient was in good health; the prostate had decreased considerably in size. Residual urine, 30 cubic centimetres.

(101) Ibid. Patient, aged seventy-eight, had symptoms of prostatic trouble for three years, during which time the catheter had been employed to empty the bladder entirely. Prostate voluminous.

Castration, August 9, 1895. At the end of six weeks no improvement was noted either in the size of the prostate or the ability to pass urine.

(102) Lendon (*Australasian Medical Gazette,* September, 1895). Man, aged eighty-two years.

Castration. The result after operation was entirely satisfactory. He never again required the use of the catheter.

(103) Levings, A. H. (*Medical News,* Philadelphia, August 17, 1895). Patient, aged fifty-one, had cystitis and two ounces of residual urine. Prostate decidedly enlarged. Since December, 1894, patient was dependent upon the catheter; both testes were suppurating.

Castration. At the end of two weeks the patient was walking about almost wholly free from pain. The urine had become acid and almost clear; the catheter was not needed; there was no residual urine. At the end of twenty-five days the left lobe of the prostate could scarcely be felt, and the right was much reduced in size.

(104) Lilienthal, Howard, New York. (Personal communication.) Patient, fifty-six years old, had suffered repeated attacks of retention. Tense but not large prostate. Several ounces of residual urine; much straining.

Castration. Symptoms of prostatic attack then present were at once ameliorated. Patient recovered, so that in two weeks he went home (South), as he thought, cured. There was a little residual urine. A year later the patient was suffering from cystitis from catheterization, and that some of the prostatic symptoms had recurred. Prostate rapidly softened after the operation. This man complained of "hot flashes," etc.

(105) Ibid. H. K., aged sixty-five years, had long suffered from an enormous prostate. Suprapubic section about six years previous.

Castration. Relief from some of the symptoms, straining, etc., and closure of suprapubic fistula. Ptyalism of a marked character supervened. (Note possible connection between action of parotid and that of testes. Note resemblance to metastasis in mumps H. L.) Patient contracted the morphine habit, became melancholy, and died about two years after the operation.

(106) Ibid. I. L., aged sixty-two years. No urination, except by catheter, for fifteen years. Fibrous enlargement of the prostate. Had a few acute attacks; finally, a severe attack with very serious symptoms. Delirium, stupor, etc.

Castration. Improvement in symptoms, and patient now alive and well about four years after operation. No urination except by catheter. No change in prostate.

(107) Loumeau (*Gaz. Heb. de Méd. et de Chir.,* November 19, 1896). Complete chronic retention for seven months.

Castration. Result excellent; patient was relieved at the end of sixteen days from further dependence on the catheter.

(108) Ibid. Complete chronic retention.

Castration. Result excellent; patient relieved in thirty-six hours.

(109) Lucas, Albert (*Birmingham Medical Review,* October, 1897). Patient, aged fifty-six, suffering with cystitis and severe hæmaturia after

instrumentation; prostate much enlarged. Suprapubic cystotomy for drainage. At the time of the first operation, sessile growth of the middle lobe, which was not removed.

Castration, January 18, 1895, at which time the suprapubic opening was enlarged. April 1 seemed much better and passed water with more ease.

(110) Lunn, J. R. (*British Medical Journal,* February 18, 1899). Patient aged seventy-two; retention and hourly micturition due to enlarged prostate.

Vasectomy. Left vas and nerves divided and tied without apparent benefit.

Right testicle then removed, and radical cure for right inguinal hernia performed. Patient's health improved, but frequency of micturition continued.

Left testicle removed a year later, when the right lobe of the prostate was found less prominent than the left. Seven months later the frequency had fallen from twenty to sixteen times to ten; there was no need for a catheter and no retention.

(111) Ibid. Man, sixty-three years old, suffered from tuberculous testes, with discharging sinuses and enlarged prostate. Five months after double castration, the prostate was quite shrunken. He has since remained quite well, and he had no abnormal frequency of micturition.

(112) Ibid. Patient aged sixty-six; retention of urine and cystitis due to stricture and enlarged prostate. Temperature, 102.4° F. Urine contained pus and albumen, and was alkaline and offensive. The bladder was drained suprapubically and the stricture divided. The bladder symptoms increased in spite of boric irrigations, and death seemed imminent.

Castration was performed. He improved rapidly, gained a stone in weight, and the urine became neutral.

(113) Macewan, David (*British Medical Journal,* October 10, 1896). Patient, aged seventy-one, had urinary difficulties for ten years, and was entirely dependent upon the catheter for seven years. Latterly, the catheter was required every two hours, and its introduction was very difficult and painful. Length of the urethra ten and three-quarters inches. Prostate very large and hard.

Castration. Testicles seemed normal, but no spermatozoa could be found. On the second day after the operation the catheter passed more easily; at the end of one month the catheter was required only every four or five hours. Prostate unchanged. Three months after the operation the catheter was required every six or seven hours, and passed with ease. Urethra, ten and a half inches in length. No appreciable change in the size of the prostate.

(114) Ibid. Patient, aged eighty-four years, had complete retention for two years. Catheter required eight times in the twenty-four hours; expulsive power feeble; urethra, ten and a half inches long. Urine alkaline, contains pus and phosphates. Arteries very atheromatous. Prostate very large and hard.

Castration. Gradual improvement; two weeks after the operation

the catheter passed with facility, and the patient had voided some urine voluntarily. No spermatozoa found in the testicles. Five weeks after operation urine had been passed voluntarily twice; urethra, nine inches in length; catheter required seven times in the twenty-four hours; it passed more easily. Two months after operation, catheter required only once in twenty-four hours; remainder of urine being passed voluntarily. Urine clear; the prostate had diminished one-half in size; the general health was greatly improved.

(115) Ibid. Patient aged sixty-four; frequent urination for seven years; worse for the past two years; there had been frequent attacks of retention requiring the use of the catheter. Urine was voided every one and a half to two hours, and with a good deal of pain. Urethra, nine and a half inches in length. Residual urine, four ounces, alkaline and contains pus; prostate much enlarged, soft, and elastic.

Castration. Testicles appeared normal and contained spermatozoa. In a week the patient felt greatly relieved; the urine could be retained for three or four hours; at the end of a month the prostate was sensibly smaller; the urine contained less pus and was passed every four hours. At the end of two months the prostate was less than half the size at the time of operation. Urine was voided naturally three times a day and once or twice at night. It was free from pus. The urethra measured eight and three-quarters inches. The general health was much improved.

(116) Meyer, Willy (*Brooklyn Medical Journal,* April, 1898). Castration. One case, satisfactory results.

(117) Morton, Charles A. (*British Medical Journal,* October 10, 1896). Patient, aged seventy years, suffered from septic cystitis; there were two ounces of residual urine; the prostate was moderately enlarged, hard, and tender.

Castration, September, 1895. Gradual atrophy of the prostate followed. One year after operation the prostate was normal in size, but the residual urine remained the same. Micturition was easier, there was no mental disturbance.

(118) Nancrede, C. B. (Proceedings of American Surgical Society, May, 1896). Patient, aged sixty-five years, was unable to pass a drop of urine without a catheter for months. There was a purulent catheter urethritis; the kidneys were diseased.

Castration. On the third day urine was passed in drops; two and a half days later several ounces were passed voluntarily at times. At the end of ten days operative results satisfactory, but death occurred in five or six weeks from infection of wounds and secondary deposits; an autopsy showed pyelonephritis.

(119) Nicholson, C. M. (ANNALS OF SURGERY, September, 1898). J. S. B., aged sixty-four, suffered for several years; obliged to urinate ten to twelve times a night, with continual straining and tenesmus; residual urine, twelve ounces. Prostate bilaterally enlarged. Rest in bed, milk diet, alkaline diuretics, and morphine suppositories subdued the acute symptoms, but they promptly returned when the patient resumed his usual habits.

Castration, April 17, 1896. No improvement; prostate larger. Prostate gland could be seen forcing forward the anterior abdominal wall.

Suprapubic prostatectomy, May, 1897, and perineal incision for drainage. Patient better than for some years, but perineal fistula persists, for which he wears a urinal.

(120) Ochsner, A. J. (*Chicago Clinical Review*, January, 1896). Patient aged sixty-five years; complete prostatic obstruction; also recurrent carcinoma of the penis. The patient was unable to pass a catheter. Prostate was the size of a hen's egg.

Castration and amputation of the penis at attachment to skeleton. Catheter was introduced and retained for one week. The patient was then catheterized four times a day for two weeks; ten weeks after the operation the prostate was only perceptibly enlarged; one year after the operation the patient reported that he had been free from suffering, and that he had passed all of the urine freely and without effort. The intervals during the day were four to six hours and eight hours at night.

(121) Park, R. (Proceedings of the American Surgical Society, May, 1896). The patient had enlargement of the prostate and also a vesical calculus.

Castration. Two weeks later the calculus was removed. At this time there was "an enormous reduction in the volume of the gland, it being no larger than that of a child."

(122) Ibid. Patient aged fifty-six years; all of the urine had to be drawn by the catheter.

Castration. Improvement was noted in forty-eight hours; there was very rapid reduction in the size of the gland.

(123) Pickerell, G. M. (*University Medical Magazine*, March, 1896). Patient, aged sixty-six, had frequent and difficult urination, and required the use of the catheter many times daily. The local pains were distressing; his sleep was disturbed. The urine was loaded with pus and mucus.

Castration, November 1, 1895. On the first day there was general amelioration of the symptoms; on the second day fourteen ounces of urine were passed voluntarily. There was a palpable diminution in the size of the prostate. The patient was free from pain; the catheter was dispensed with; urine almost entirely clear; general condition excellent. February, 1896, the patient remains well.

(124) Pilcher, L. S. (ANNALS OF SURGERY, June, 1896). Patient aged sixty-two years. Some difficulty for seven years or more; perceptible progressive aggravation during last year and a half, culminating in absolute retention; catheter can be passed. To the rectal touch prostate feels of the size of a base-ball, being symmetrically enlarged. After one week of catheterization, April 29, 1896, was subjected to

Castration. On fourth day thereafter began to pass some urine voluntarily; the amount passed gradually increased until at the end of two weeks, date of report, it is all passed voluntarily; but upon introduction of catheter eight fluidounces of residual urine are always found present. There is considerable cystitis still present.

(125) Ibid. Patient, seventy years, has been mainly dependent upon

catheter for one year, and absolutely so for six months; has a mild degree of cystitis. Rectal examination reveals a massive enlargement of the prostate, to the farther border of which the finger does not reach. May 6, 1896, was subjected to

Castration. On the seventh day thereafter began to pass urine in slight amount naturally; the amount of urine voided naturally has gradually increased up to the date of this report, two weeks after the operation; but the greater part of the urine is still passed by catheter.

(126) Post, A. (*Boston Medical and Surgical Journal*). Patient, aged fifty-nine years, obliged to pass urine every hour while six ounces residual remained. Prostate very much enlarged, and a very distinct bar could be detected.

Castration. The intervals of urination having increased from two to three and a half hours; there is but one-half the former amount of residual urine; a good deal of pain and discomfort have disappeared. The prostate does not seem much changed.

(127-129) Poulten (*Australasian Medical Gazette*, September, 1895). Castration. Three cases, aged sixty, fifty-one, and seventy-three. All successful.

(130) Ricketts, Merrill. (Personal communication.) R., aged sixty-three; merchant; had suffered for five years, being obliged to urinate eight to ten times daily. Cystitis and occasionally hæmaturia; right lobe of the prostate was enormous; had also extensive anal hæmorrhoids, which were removed at time of emasculation. Habits excellent; not accustomed to stimulants.

Castration, July 8, 1898. Improvement noticed within forty-eight hours; relief from pain at end of two weeks. Decrease in size of prostate, and general condition, September 1, greatly improved. Final result good.

(131) Ibid. D., aged fifty-four, capitalist, formerly railroader, suffered for five years, urinating twenty times daily; pain severe, with temperature at 104° F.; residual urine present and abscess of prostate; complete retention of several hours each for three days; catheter passed with difficulty; extreme cystitis; prostate several times normal size, general health critical. Medical treatment occasional during history of disease without avail. Perineal section four days after admission for drainage. Continued to become worse until end of twenty-sixth day, when

Castration was performed, May 5, 1896. Perineal opening closed at this time. Improvement occurred within three hours and continued rapidly. He gained from eighty-six pounds to 186 pounds in six months. September 1, 1898, health most excellent.

(132) Ibid. R., No. 2, aged fifty-six; machinist; symptoms of prostatic trouble for four years, following cystitis from gonorrhœa; frequent urination; retention once, April, 1897; irrigating catheter passed with difficulty; prostate several times larger than normal. Medical treatment constant for four years without avail. Stricture cut internally at age of forty-five. Quite extensive drinker of stimulants; had syphilis at age of twenty-eight.

Castration, April, 1897, proved successful; relief from pain at end of fifteen days; decrease in residual urine; cystitis disappeared and prostate decreased in size. September 1, 1898, has had no more trouble, and does his usual work.

(133) Ibid. L., aged fifty-two, suffered from prostatic irritation for two years. Micturition very frequent both day and night, with severe pain. Cystitis. Had gonorrhœa three times before the age of forty. Prostate exceedingly large; had prostatic abscess last attack of gonorrhœa. Extensive medical treatment. A very dissipated man in all things. Drank alcohol excessively.

Castration, March, 1896. Improvement apparent in forty-eight hours; relief from pain at end of ten days; cystitis disappeared and prostate decreased. September 1, 1898, general health very good, though he continues to drink alcoholic stimulants.

(134) Ibid. A., aged fifty-nine; capitalist. Symptoms of prostatic trouble for five years; severe pain with cystitis; prostate much larger than normal; general health poor, in bed for eight months; mental condition only fair. A neurotic. Extremely hysterical.

Castration, July, 1897. Improvement noticed within forty-eight hours; pain diminished; residual urine decreased and spontaneous urination returned. September 1, 1898, fat, well, and happy.

(135) Ibid. S., forty-nine years old; saloonist; first noticed the trouble four years previously; urinated fifteen to twenty times daily, suffered severe pain; retention of urine; prostate three or four times natural size. General health poor; medical treatment without avail; had abscess of prostate at last attack and four weeks previous to time of operation. Consumes from three to five glasses of beer daily, and very dissipated in his general habits.

Castration, May 15, 1896. Improvement showed in two weeks; frequency of urination diminished to less than half at end of week; cystitis persisted for ten weeks; prostate decreased; improved slowly; but September 1, 1898, urinates more often than he should, but satisfied with the result.

(136) Ibid. H., aged seventy-two; symptoms of two years' standing; urinates fifteen to twenty-five times daily; less frequent at night; severe pain; residual urine; difficult catheterization and cystitis. Prostate very large; general health very much shattered; mental condition good, but no sexual power. Medical treatment without benefit. Had been a tall, strong, active man who did not use stimulants, and whose other habits were good.

Castration, July, 1893. Improvement noticed within twenty-four hours. Frequency of urination diminished to less than half within a week; relief from pain at end of a month; cystitis disappeared and prostate showed a decrease. Practically well at the end of five years.

(137) Ibid. C., aged sixty-four; merchant. Symptoms of prostatic trouble for six years and very frequent micturition; residual urine and cystitis. Prostate very large; general health much impaired; medical treatment, travel, and lithia water without avail. Habits good, not accus-

tomed to stimulants. Smoked rather extensively. No history of specific disease.

Castration, May, 1895. Improvement manifest within seventy-two hours; pain ceased at end of three weeks, with decrease in residual urine; cystitis disappeared and prostate decreased. September 1, 1898, exceedingly good health; patient satisfied with the result.

(138) Ibid. H., No. 2, aged sixty-one; merchant; complained of prostatic trouble for three years; urination very frequent, with pain and complete retention on four different occasions during the three years, necessitating the use of a catheter; cystitis was extreme at times; prostate was very large. Medical treatment without avail. Extensive anal hæmorrhoids present for a number of years; they were operated upon eight months previous to emasculation and entirely cured. Habits good as to drink, but poor as to food. "High liver."

Castration, August, 1897. Improvement noticed within four days; frequency of micturition greatly lessened; pain relieved at end of four weeks; residual urine decreased and spontaneous urination returned. Prostate decreased very much; general condition much improved. September 1, 1898, attends to business with ease and comfort, having had no trouble since operation.

(139) Ibid. B., aged seventy-nine; statesman and capitalist; suffered from prostatic irritation for one year, being obliged to urinate eighty-four times in twenty-four hours just previous to admission to hospital. Suffered severe pain with cystitis and residual urine. Prostate enormous. Medical treatment only without avail. Weight from 200 to 250 pounds. Habits most excellent. Never tasted stimulants; never smoked or chewed.

Castration, June, 1895. Improvement noticed within twelve hours; frequency of urination reduced one-half within a week; return of spontaneous urine and cystitis disappeared; prostate decreased. Urinated but eight times in twenty-four hours at end of month. Died three months later from uræmia. Some albumen in urine. No autopsy.

(140) Ibid. P., aged sixty-two; speculator; had first noticed symptoms eight years previous. Obliged to urinate several times daily; severe pain; retention constant for seven years, and catheter passed with difficulty; cystitis and hæmaturia occasionally. Prostate very large; general health much impaired; neurotic, hysterical. Medical treatment without avail. Applied galvanism to prostate seven years ago; no benefit. A very excitable man, hard worker, extremely temperate in all things. Suppression of urine and chills at time of admission to hospital.

Castration, February 27, 1898, after which improvement was noticed within a few hours. Pain subsided at end of three weeks; residual urine decreased and spontaneous urination returned; cystitis disappeared in sixty days along with decrease in the size of the prostate. General condition greatly improved. September 1, 1898, condition excellent and attends to business. A most satisfactory result.

(141) Routier, A. (*La Méd. mod.*, No. 14, 1896). Patient, aged

sixty, had severe attacks of complete retention, requiring the use of the catheter; prostate large, especially on the left side.

Castration. Voluntary urination on the same day. Fifteen days after operation, lymphangitis of the abdominal wall, with suppuration; "perfect cure, but some cerebral trouble."

(142) Schnitzler (*K. k. Gesellsch. der Aerzte,* in Wien, January 10, 1896). High grade prostatism.

Castration. Five weeks afterwards the patient was able to pass all his urine spontaneously, and has continued to do so, catheter being entirely discarded; the prostate showed distinct diminution in size.

(143) Socin, A. (*Correspondenzblatt für Schweizer Aerzte,* 17, 1896). Patient aged seventy; in 1893, perineal section of the prostate had been performed. May, 1895, prostate was as large as before.

Castration. Patient affected constitutionally and recuperated slowly. The prostate became smaller and urination less painful and frequent. The amount of residual urine decreased.

(144) Southam (*British Medical Journal,* February 22, 1896, page 463). Man, aged sixty-six; had difficult urination for a long time; no urine had been passed except by the catheter for over two years. It was necessary to use a No. 6 English silver catheter, which caused great pain, and blood usually followed its introduction. The urine was alkaline, offensive, and contained pus, blood, and ropy mucus. Prostate was enlarged. The urine was drawn regularly four times a day. The bladder was irrigated with boric solution, and salol was administered internally; at the end of a fortnight of this treatment there was no improvement, except that the blood had disappeared.

Castration, September 28, 1895. On the fifth day the patient passed half an ounce of urine spontaneously, and the catheter passed more easily; on the sixth day one or two ounces of urine passed naturally, and on several subsequent occasions. On the seventh day the same amount of urine was passed, and it became acid for the first time. February, 1896, five months after operation, the patient still passes his urine voluntarily; prostate is diminished in size, and a full-sized instrument passes without difficulty; the urine is acid, clear, and free from pus and blood.

(145, 146) Stimson, L. A. (*Brooklyn Medical Journal,* April, 1898). Castration, two cases; benefit in one.

(147) Thayer, F. C. (Personal communication.) Man, aged fifty-eight; painter; first trouble five years ago. Three years ago got up once or twice at night. The frequency increased to every hour or two. There was dysuria, and six to eight ounces of residual urine. Patient lost flesh. Prostate was the size of a small orange. Regular catheterization for several days did not diminish the amount of residual urine.

Castration, October 24, 1896. After the fourth day the residual urine gradually diminished until the sixteenth day, when there was none. December 13, 1896, no residual urine; sleeps all night; intervals of six hours between urination. Prostate almost impalpable; the catheter draws urine at seven inches, while before operation it was nine and a quarter.

(148) Vigneron (*Gaz. Heb. de Méd. et de Chir.,* November 19, 1896).

Man, aged sixty; suffered from dysuria for two years. One year after complete retention. All of the urine was drawn by catheter, which was used every two hours; retained catheter employed for eight days; moderate hypertrophy of the prostate.

Castration, October 8, 1896. At the end of eighteen days, half of the urine was passed voluntarily, easily, and freely.

(149) Vautrin (*Ann. des Mal. des Org. Gen.-Urin.*, March, 1896). Patient under treatment for some months without benefit; catheter employed twice daily.

Castration, May 21, 1895. On the fifth day the patient passed urine frequently and twice as satisfactorily. Sixth day urination easier and spontaneous all day. On the eighth day the catheter was dispensed with; tenth day the patient up in a chair well; seven months later the improvement was maintained.

(150) Walker, H. O. (*Medical News*, Philadelphia, November 30, 1895). Patient aged sixty-five years; prostatism for eight years; cystitis; large amount of residual urine; frequent urination; catheter required at short intervals; prostate very much enlarged; palliative treatment employed without benefit.

Castration, February 10, 1895. On the ninth day the catheter was discarded; at the end of two weeks urine could be retained four to nine hours; pain had all disappeared, and there was but little pus in the urine. The prostate had perceptibly diminished in size. All of the urine passed spontaneously and without effort.

(151) White, J. William. Prostatism for some years; frequent urination and incontinence; several attacks of retention; aspiration once in January, 1895; February 7, 1895, suprapubic cystotomy for drainage.

Castration, May 14, 1895. No change noted at the end of one year.

(152) Ibid. Patient had residual urine; inability to empty bladder; frequent desire and pain.

Castration. Four weeks after operation symptoms unchanged. Prostate perhaps a little softer; on the posterior wall of the rectum there is a hard nodule (carcinoma).

(153) Ibid. Patient aged seventy-three; prostatism for one year; marked cystitis, complete retention, moderate enlargement of the prostate. Catheter used with increasing frequency; finally every hour. The glans "burned like a coal of fire" as soon as any urine collected in the bladder. Painful erections at night.

Castration, May 8, 1896. The urine rapidly lost its foul odor, the pus disappeared, and the secretion became natural in odor, color, and composition.

(154) Ibid. Patient aged sixty-five; symptoms for fifteen years; catheter employed for ten years; for the last six or seven years no urine passed spontaneously. Prostate about three times the normal size; left side larger than the right.

Castration, May 6, 1896. On the third day the catheter passed more easily. June 1, 1896, catheter used six or eight times in twenty-four hours; general improvement in health; prostate decreased in size, but

nodules are felt on the posterior and lateral surfaces; catheter draws urine at eight and a half inches, while before operation the urethral length was ten and a quarter inches. No urine has been passed spontaneously.

(155) Ibid. University Hospital, No. 1895. P. K. H., aged sixty-eight; farmer. Enlarged prostate and vesical calculus. Admitted January 30, 1897. Three years ago he began to get up two or three times at night to urinate. For the past two years efforts to urinate have been painful and more frequent, and stream dribbles. Began using catheter ten months ago, at first two or three times a day, and for past three months at every urination (one and a half hours). Now is unable to empty bladder without catheter, although he can pass a few drops by straining. Considerable tenesmus. Before entering University Hospital, Dr. White attempted to introduce a vesical sound, but was unable to pass obstruction at neck of the bladder.

Castration, performed February 3, 1897, through one wound. March 13, 1897, vesical sound passed without trouble and calculus found. Prostate slightly diminished in size. Patient much improved, and is passing small quantities of urine voluntarily. March 15, 1897, went home; self-catheterization every three or four hours. April 30, 1897, litholapaxy performed; small stone crushed without any trouble. May 7, 1897, goes home feeling well. Passes small quantities of urine voluntarily and catheterizes himself about every five hours.

(156) Ibid. University Hospital, No. 1921. J. J. K., aged seventy-two. Gradually increasing frequency and difficult urination for past twelve years. Irregular catheterization for the past twelve months, and cystitis.

Castration performed May 8, 1896. Left the University Hospital three weeks later. Marked improvement in quantity of urine passed and lessening of pain and frequency of urination for the following six months, rarely using the catheter, and then gradual return to worse than former condition. March 3, 1897, prostate probably larger and harder than before operation. Patient uses catheter twice daily, four to eight ounces, and voids a few drops every ten to twenty minutes with much straining. March 10, 1897, went home. Refused to permit catheter to remain in on account of irritation; is to use catheter at home. Vesical sound not long enough to enter bladder.

(157) Ibid. University Hospital, No. 1926. D. M. B., aged sixty-four; civil engineer. Enlarged prostate. Frequent and unsatisfactory urination began four or five years ago and gradually increased. Commenced self-catheterization two years ago, and now catheterizes himself three times during the day and twice during the night without trouble. He had several attacks of orchitis, the last (double) being about two months ago, spontaneous rupture, discharging blood, urine, and purulent matter through opening on anterior surface of scrotum, which has since closed up under treatment. Felt well and never stopped work except during last attack of orchitis. March 11, 1897, vesical sound passed without difficulty; no stone. Bladder is moderately distended and markedly ribbed. Prostate is about the size of an orange and of moderate hardness.

Length of urethra, eleven and three-quarters inches; urine is slightly albuminous.

Castration, March 13, 1897. Both testicles showed signs of previous suppuration. March 26, 1897, died from weakness of four or five days' duration. Confused intelligence shown before operation was performed. Wound doing well. Has passed two ounces of urine voluntarily several times. Slight trace of albumen.

(158) Ibid. University Hospital, No. 2140. N. E. M., aged seventy-one; difficult and frequent urination began sixteen years ago, at first worse in morning and gradually increasing. Commenced to use catheter at irregular intervals fifteen years ago. During past two or three years abdomen has been sore and swollen, pain in lumbar region, feverish, and used catheter every two to four hours day and night. Urine has been foul for five or six years, and of late bloody and preceded by mucus. Constipated for the past six or seven months. Urethra eleven and one-quarter inches long; urine all residual.

Castration performed December 17, 1897. December 21, 1897, slight attack of hiccough, which attack gradually became more frequent and trying, and diarrhœa set in on December 25, 1897; mental condition became impaired, became comatose; December 29, 1897, general condition became worse, and died on January 2, 1898. Wounds had nearly healed, and improvement in urinary symptoms noted before he began to fail.

(159) Ibid. University Hospital, No. 1680. J. S., aged sixty-one; carpenter. Has been suffering from frequent and painful urination for seven years (dating from a fall on head), with rapid increase, a teaspoonful dribbling away at a time. Began to use the catheter about five times during the day and once at night, now every hour day and night. Has had swelling on right side of scrotum for five days. Tapped four times, twice during the past week, when physician pronounced the fluid pus. Cannot void a drop of urine naturally. Arteries show marked degree of sclerosis. Catheterization seems very painful. Length of urethra, ten and a half inches. Prostate about three times its normal size. Swelling on the right side of the scrotum about the size of a fist, which on tapping gave small quantity of pure pus. Urine shows pus and some albumen. Catheter used every half-hour.

Castration performed, when the right testicle was found to be suppurating. June 28, 1896, patient secreted but very little urine after the operation; mental condition became impaired, and he gradually sank, dying June 28, 1896.

VASECTOMY.

(1-4) Bangs, L. B. (New York Academy of Medicine, January 12, 1897). Vasectomy; four cases; unsuccessful.

(5) Bosquet (*Ann. des Mal. des Org. Gen.-Urin.*, November, 1896). Patient aged seventy-seven years. Six months before operation had attack of retention, and two subsequently. Prostate very large.

Vasectomy, April 14, 1896. Third day catheterization easier, and the patient urinated twice voluntarily. At the end of a month voluntary mic-

turition was performed satisfactorily, and the prostate had diminished two-thirds.

(6) Ibid. (*Gaz. Heb. de Méd. et de Chir.*, No. 95, 1896). Patient aged seventy-six; acute retention of urine; enormous hypertrophy of the prostate.

Vasectomy. On the second day the patient voided urine naturally. Extensive false passages had been made by the resident surgeon. In spite of this, spontaneous urination was re-established on the fifth day. Prostate much atrophied and micturition continues easy.

(7) Brasher, C. W. J. (*British Medical and Chirurgical Journal*, June, 1896). Patient, aged seventy-nine, had several attacks of retention; catheter was required three or four times a day, and was introduced with difficulty. Profuse hæmorrhage frequently followed the introduction of the instrument. Prostate the size of a tangerine orange and hard. Rest in bed and routine treatment for several days gave no relief.

Vasectomy. On the third catheterization there was no blood. Spontaneous urination returned the next day (December 24, 1895); six ounces passed naturally; nine ounces on the second day and fourteen ounces on the third day. Prostate decreased to less than *two-thirds its former size, and the general condition was greatly improved.* May 15, 1896, the patient has made fairly rapid progress towards almost complete recovery.

(8) Brisch (*Centralb. f. d. Krank. d. Harn. re Sex. Org.*, November 8, 1896). Patient aged sixty-eight; prostatic symptoms for ten years. The past five years there was considerable urinary difficulty. The patient is unable to empty his bladder, and is obliged to void urine thirty to forty times a day. Prostate enlarged and hard.

Vasectomy, under cocaine anæsthesia, gave excellent results. The patient passed water every three hours during the day and every two hours at night. The prostate decreased considerably in size.

(9-14) Carlier (quoted by Bosquet, *Gaz. Heb. de Méd. et de Chir.*, No. 95, 1896). Vasectomy; six cases. The dysuria persisted as bad as before. The cases were all considered unsuccessful.

(15) Chetwood, Charles H. (*Journal of Cutaneous and Genito-Urinary Diseases*, March, 1897). Man, aged fifty-three; had retention, June, 1895; February, 1896, prostate found symmetrically enlarged and about the size of a hen's egg. The third lobe was prominent.

Vasectomy, February 13, 1896. One year later the condition is reported as really worse; the amount of residual urine has increased, and the difficulty in voiding it is greater. There had been frequent attacks of retention and the prostate was the same size or larger.

(16) Colclough, W. Frank (*Lancet*, London, September 7, 1897, page 658). Patient, aged seventy, suffered from prostatic trouble for three years. There was acute cystitis, October, 1894; the prostate was symmetrically enlarged. December, 1895, the patient suffered from urethritis; the catheter was required every six hours. The left lobe of the prostate had increased considerably in size. There was a fixed, dull, aching pain in the kidney. The conditions gradually became worse; no urine was passed except by catheter, and life had become a burden.

Vasectomy, November 11, 1896. During the night urine was passed naturally every hour, but with a little pain. Urine continued to pass naturally, and the pain gradually diminished. November 19, the right lobe of the prostate was about one-half the size it was before the operation. The left lobe remained about the same size, but was much softer in consistence. November 20, about two pints of urine were passed naturally. The health gradually failed and death in coma occurred December 18.

The necropsy showed that the prostate was simply a bag of pus, the middle lobe of the prostate was soft and pendulous, one and a half times five-eighths of an inch. The left ureter was the size of the forefinger, and at the junction with the bladder was lost in a new growth, two and three-quarters times one and three-quarters inches. There was little or no renal tissue in the left kidney, which was merely a bag of pus.

(17) Dawbarn, R. H. M. (ANNALS OF SURGERY, June, 1898, page 766). Man, aged sixty-three; had suffered from chronic hypertrophy since October, 1894. Four ounces of residual urine. Chronic cystitis (in spite of irrigations), chronic nephritis. The patient was taught self-catheterization, and was repeatedly put to bed, the bladder irrigated, etc. As soon as the use of the catheter was stopped, the urine promptly became alkaline and was passed every thirty minutes.

Vasectomy. Two to three centimetres of the vas were removed November, 1897. Catheter employed only once afterwards. Within a month the patient could hold his urine for two or three hours, and the interval gradually lengthened until it reached four to six hours, and he did not rise at night to urinate. Prostate shrunk fully one-third its size. Testicle also shrunk. Power of erection had been lost for a long time before operation. The man's urine at the time of the report was perfectly clear, although it still contained the evidence of Bright's disease.

(18-39) Drézigné reports in the *Bulletin of Medicine*, of January 3, 1897. Vasectomy, twenty-two cases. Notable improvement in each. The effect seems to be the same, whether the vas is resected or merely cut. The author did not obtain any benefit from the unilateral operation.

(40) Dumstrey (*Centralb. f. Chir.*, November, 1896). Man, aged sixty-five, had complete urinary retention and cystitis, due to prostatic hypertrophy. Prostate about the size of a fist.

Vasectomy. Decided relief in a few days; patient could pass urine spontaneously. It became less turbid, and day by day contained less pus and blood. The prostate was reduced in size one-half. The general health and strength, however, became impaired. The patient appeared to have aged very much. His movements were slow and clumsy; he was unable to express his thoughts or to comprehend what was said to him.

(41) Erdberg (*St. Petersburg med. Woch.*, No. 33, 1897). Vasectomy, successful.

(42) Gelpke (quoted by Socin, *Correspondenzbl. für Schweizer Aerzte*, No. 17, 1896). Man, aged sixty-six; prostatism; for two years he urinated twelve to fifteen times in the twenty-four hours. During the last year there had been acute retention four times.

Vasectomy, April 27, during the last attack retention. In twenty-

four hours he could pass urine voluntarily. Was only obliged to empty the bladder four to six times a day. Some mild nervous symptoms followed, but gradually disappeared.

(43) Guyon (French Congress of Urologists, Paris, 1896). Patient had complete retention of urine, for which cystotomy was performed. After several days catheter could be introduced. It was allowed to remain for several days, and upon its removal the retention recurred.

Vasectomy. No improvement; castration was performed later, *q. v.*

(44) Harrison, Reginald (*The Lancet*, London, January 8, 1898, page 94). Patient, aged seventy-two, had frequent desire to urinate, and pain and distress from the frequent use of the catheter.

Vasectomy on one side, April 13; on the other, May 11. The patient slowly but steadily improved.

(45-51) Ibid. (*British Medical Journal*, October 10, 1896). Vasectomy, ten cases; in five there was great and lasting bentfit. Two were unimproved, and *two could not be traced. One case was too recent to report.*

(52-94) Herold (*Deutsche med. Woch.*, January 14, 1897) adds three cases to the forty-one which he collected. Thirty were entirely relieved; a proportion of 72 per cent; two died.

(95-97) Jackson, T. Vincent (*Edinburgh Medical Journal*, February, 1900). E. C., aged sixty-four; joiner; married; was admitted to hospital, February 8, 1897. States he has had straining and frequency of micturition for several months past, both by day and by night, accompanied with constant dribbling. The straining is very severe; no blood passed. The bladder was sounded, but no foreign body detected, neither was there a middle lobe or a collar around the vesical termination of the urethra. The prostate was large in all directions, reaching backward beyond the point of the forefinger. The enlargement was uniform, and the elastic resistance equal at every point,—non-nodular,—and it invaded the lower portion of the capacity of the rectum.

Vasectomy, February 13, 1897. February 27, radical cure for left inguinal hernia performed; also excision of a portion of the left vas deferens. April 28 discharged perfectly well, passing his urine easily, varying in amount from two to three pints or more daily.

(96) Ibid. J. A., aged seventy-three; married. Thirty years ago commenced to have difficulty in passing urine, and this continued and increased until a complete inability to do so supervened. He describes his existence as being "horrible;" pain was almost continuous; retention of urine was constant, and an involuntary dribbling more or less present day and night. Constipated, general health impaired, and suffered great mental depression. Finally, in despair, cut his throat, and when admitted to hospital was in a very exhausted and enfeebled state. Rectal examination with the right forefinger revealed that the anterior wall of the gut was much pressed down, and, indeed, impeded the passing of the finger upward, due to a very great symmetrical enlargement of the entire prostate, and finger-point could not touch base. The largest prostate I have examined. Firm and elastic, but uneven in places; no tumor or isolated bulging was discovered.

Vasectomy performed March 22. April 24, catheter discontinued, patient passing the whole of his urine himself. An examination of the rectum showed that its capacity was now normal; the prostate had much lessened in bulk all over; the point of the finger easily passing beyond the base line to the lower wall. May 24, patient discharged free from all urinary discomfort and happy in his mind.

(97) Ibid. F. B., aged fifty-eight; married; bootmaker. Suffered from complete retention of urine for two or three days previously. Habits temperate. A soft catheter being passed, relieved the retention, and it was regularly continued. The prostate was found to be uniformly much enlarged, base line being beyond the reach of forefinger.

Vasectomy (right) performed August 19, 1899, one and a half inches of the vas being removed. September 2, wound perfectly sound; passes his urine freely; catheter used night and morning, he having been taught how to do so. September 6, prostate still uniformly enlarged, but reduced to one-third of its original size, the point of the forefinger reaching the base of gland. September 8 discharged; passes his urine easily and at will; instructed to pass the soft catheter every night before going to bed. This man has lately been seen, and he states he is perfectly well and comfortable, all his troublesome urinary symptoms having left him.

(98) Jones, Robert (*The Lancet*, London, February 6, 1897, page 383). Vasectomy. Considerable amelioration of symptoms took place.

(99) Ibid. (*British Medical Journal*, November 5, 1898, page 1416). Man, aged fifty-six; had old chronic prostatic symptoms; symptoms of stone in the prostate and bladder also.

Vasectomy performed, which resulted in a decrease in the amount of residual urine, but no change in the prostate. The author and Dr. Thompson, however, were convinced of considerable amelioration in symptoms. Suprapubic cystotomy was later performed, which resulted in a large stone being removed from the bladder and a small one from the prostate, with considerable benefit.

(100, 101) Kammerer (New York Academy of Medicine, January 12, 1897). Vasectomy, two cases; first, aged sixty-five, unsuccessful at the end of four months; second, acute retention, condition very bad. The day after the operation the patient was able to pass his urine; at the end of three weeks the prostate had decreased considerably in size.

(102) Kane, H. H. (Personal communication.) Patient aged sixty-seven; great enlargement of the prostate; at times urine is voided every twenty minutes day and night; urethral length, nine and a half inches.

Vasectomy. No improvement.

(103) Ibid. Patient, aged sixty-two, was obliged to urinate every hour of day and night. Urine contained pus, mucus, and blood; patient had been unable to empty bladder for a number of years. Length of urethra, ten and a half inches; prostate was very hard.

Vasectomy, June 30, 1896, under cocaine anæsthesia. No improvement.

(104) Köhl, E. (*Correspondenzbl. für Schweizer Aerzte*, 19, 1896). Patient, aged seventy-four, suffered for a long time with urinary troubles;

began the use of the catheter in February, 1896; catheter caused more and more pain, and finally hæmorrhage. False passages had been made.

Vasectomy, April 8, 1896. The following day urine was passed less frequently and with greater ease. The patient was up on the fifteenth day, and was discharged three weeks after the operation. The patient's condition was improved, and he felt well satisfied with the operation, although the prostate remained about the same size.

(105-108) Loumeau (French Congress of Urologists, Paris, 1896). Vasectomy, four cases. No improvement in any excepting in two cases the recurring attacks of orchitis caused by the catheterization ceased.

(109) Lucas, Albert (*Birmingham Medical Review*, October, 1897). Patient, aged sixty-five, had suffered for four years; residual urine, ten ounces.

Vasectomy performed August 27, 1896, after which the right testis became a little atrophied, but the left remained normal. September 30 was much improved. October 21, the same. January 6, 1897, no better than before the operation.

(110) Ibid. Patient had had complete retention of urine; cystitis and urine very fetid.

Vasectomy. Died of surgical kidneys, but not from operation.

(111) Lunn, J. R. (*British Medical Journal*, February 18, 1899). Patient, aged sixty-four, had retention, for which catheterization was required. The urine was alkaline, contained albumen, and had a specific gravity of 1005.

Vasectomy under chloroform was performed. One month later he could sleep all night without passing urine, and he was discharged.

(112) Ibid. Man, aged seventy-six; retention; frequent micturition day and night. Catheterism often required. Prostate much enlarged. Left vas and nerves cut and tied under 10 per cent. cocaine injection, but no improvement followed.

Vasectomy seven weeks later, right vas was tied under 5 per cent. cocaine injection. Twelve days afterwards the frequency of micturition was much lessened. Five months later cancer of the liver appeared, of which he died. At the autopsy both testicles were found to be atrophied, and he had developed a double hydrocele of the tunica vaginalis.

(113) Ibid. Aged sixty-three; micturition about every half-hour. Catheterization often necessary; urine offensive through frequency of micturition.

Right vasectomy. Three months later again had retention; palliative treatment. One month later, ligature of left vas and nerves prostate had apparently not altered much in size, but felt soft. One month later micturition reduced to four or six times in twenty-four hours, and no micturition all night. Before last operation, micturition was frequent at night. The urine became normal. Patient went out well.

(114) MacEwan, David (*British Medical Journal*, October 10, 1896). Patient in a condition of advanced prostration.

Vasectomy. Death within a week from uræmia.

(115) Ibid. Patient, aged sixty-five, had had urinary difficulties for

seven years. He had been entirely dependent upon the catheter for three years, which he used with pain and difficulty six or seven times during the day and twice at night. The urine was alkaline and contained pus and phosphates. The prostate was much enlarged and hard. The urethral length was ten inches.

Vasectomy. One month later the catheter could be passed more easily; it was used every four hours; a small amount of urine was passed voluntarily, the first time for three years. The prostate remained unchanged. Two months after the operation the catheter was used every five hours with ease. The patient says "There is no lump to get over;" length of urethra, nine and a half inches; no change in the size of the prostate as felt per rectum. The urine is clear. There was no visible atrophy of the testes.

(116-118) Moullin, C. W. Mansell (*British Medical Journal*, October 10, 1896). Vasectomy, three cases. In two there was considerable improvement, although the prostate did not change much. The third case died of uræmia, after improving a little for a time.

(119) Nové-Josserand (*Lyon Médical*, No. 40, 1896). Patient, aged seventy; had retention in 1890; improved under regular catheterization. In 1894 had complete retention, requiring the use of the catheter every three hours.

Vasectomy, August 1. Local anæsthesia. Improvement was noticed a few days after the operation. On September 1 the patient was able to pass thirty grammes of urine naturally; later, suprapubic cystotomy was performed for stone.

(120) Ibid. Patient, aged sixty-two, had dysuria for twenty years. June, 1896, had acute retention. June 15, the retention persisted. Prostate was voluminous, especially the right lobe.

Vasectomy, June 30. There was epididymitis and funiculitis. The epididymis suppurated; some days after the operation urine was passed in drops. On July 7 it is noted that the patient passed urine more and more freely and naturally. There was slight mental disturbance for a few days. The patient left the hospital perfectly well. The prostate was slightly smaller.

(121) Ibid. Patient aged sixty-eight; prostatism for ten years; there was nocturnal frequency and dysuria. December 1, 1895, there was absolute retention. Prostate was markedly enlarged, especially the right lobe.

Vasectomy, December 12, 1895. There was complete retention for three days, then incontinence was present. In February the patient was continent and passed his urine painlessly. In August there was no residual urine to mention. The patient considered himself well.

(122-155) Pavone (*Il Policlinico*, No. 15, 1896). Vasectomy. Thirty-four cases. Twenty-eight were cured or improved; in two the results were negative; four died of other diseases.

(156) Walker (*University Medical Magazine*, July, 1897). Man, aged sixty-seven; unable to pass any urine without catheter.

Vasectomy. Within about two days the patient began to void some urine naturally, and two weeks after operation was able to empty his blad-

der with exception of about three ounces. Testicles became soft; prostate was soft, and the catheter passed more easily.

(157) White, J. William. A. F., aged seventy; patient able to pass but a small quantity of urine at a time, although the efforts were at frequent intervals. Residual urine twenty to twenty-four ounces. Prostate size of a mandarin orange. The patient was feeble and his general condition very poor.

Vasectomy, January 9, 1897. After operation, the residual urine amounted to from twelve to sixteen ounces, and later was six or eight ounces. The patient was less disturbed at night. The left wound became infected and suppurated for a few days. The prostate appeared to have decreased about one-quarter in size.

(158) Ibid. Mr. P., aged sixty-eight. The usual symptoms of prostatic obstruction of moderate degree; six ounces of residual urine.

Vasectomy, January 19, 1897. The frequency of urination diminished and the residual urine decreased.

(152) Ibid. University Hospital, No. 2128. Dr. C. W., aged sixty-eight; the usual symptoms of pronounced prostatism.

Vasectomy, November 30, 1897. December 6, 1897, the patient left the hospital much improved.

(159) Ibid. University Hospital, No. 2128. Dr. C. W., aged sixty- marked prostatism.

Vasectomy, March 2, 1898. Patient was very much benefited. Letter dated May, 1898, states that the improvement continued.

(161) Ibid. University Hospital, No. 1886. C. G., aged seventy-eight; carpenter. Retention of urine two weeks previous to admission. No previous symptoms; catheterized twice daily since. Albuminous urine. Orange-sized prostate.

Vasectomy performed January 27, 1897. February 6, 1897, wounds healed by first intention. Prostate seems one-third smaller. February 25, 1897, urinary conditions improved; is becoming stupid and weak. March 14, 1897, died from general weakness; has been catheterized at irregular and infrequent intervals since operation, passing most of his urine naturally and comfortably.

(162) Ibid. University Hospital, No. 1974. P. B. D., aged seventy-four; engineer. Two years ago began to have some irritation on urinating, and frequency gradually increasing until now he passes it (naturally) about every one and a half to two hours day and night with some difficulty and in small quantities, but without pain passes from one to four ounces. Prostate about one-half size of a mandarin orange; trace of albumen; residual urine, nine ounces; length of urethra, ten inches.

Vasectomy done April 18, 1897, under local anæsthesia. April 14, 1897, union. April 19, 1897, went home in poor general condition; has been drowsy and stupid for several days. Prostate and residual urine about the same.

(163) Ibid. University Hospital, No. 1976. J. H., aged sixty-nine; watchman; has had very gradually increasing frequency of urination, going on from fifteen to twenty years. First used catheter one week ago

and since every six hours, eight ounces each time. March 23, 1897, meatotomy. Prostate is very large and fairly hard. Difficult catheterization, urethra bleeding freely. Urine negative.

Vasectomy, March 25, 1897. At night catheter passed and tied in. March 31, 1897, wound healed and catheter removed. April 8, 1897, discharged improved. Passes urine more easily and at longer intervals than formerly for three years. Residual urine, six ounces.

(164) Ibid. University Hospital, No. 1984. J. M., aged sixty-eight; farmer. Six months after exposure to cold and wet began to have very frequent painful and bloody urination, which still persists, and weak stream. Middle lobe of prostate considerably enlarged; urine is ammoniacal and contains blood and pus.

Vasectomy, May 25, 1897. June 2, 1897, discharged better in every way; wound aseptic. Urine improved; less frequency of urination. Size of stream and difficulty in urinating about the same.

(165) Ibid. University Hospital, No. 2045. C. K., aged seventy-two; farmer. Frequent (two or three times at night) and difficult urination for past five years. Irregular catheterization for past fourteen months. Blood in urine at times. Prostate soft and about the size of a mandarin orange. Trace of albumen and some fever. Length of urethra, eight inches; residual urine, fifteen ounces; is unable to pass any urine himself; catheterized three to four times daily.

Vasectomy, June 26, 1897. July 9, 1897, discharged; some urinary improvement. Prostate one-half its former size. Length of urethra, ten inches. Catheterization still necessary, but easier. Mental condition is worse. Confused, lack of memory, etc.

(166) Ibid. University Hospital, No. 2076. W. H. Y., aged fifty; gardener. Painful and frequent urination with gradual increase for the past ten months. Never been catheterized. Lost forty to fifty pounds in the past six months. Much pain in perineum and testicles. Urine is ammoniacal, albuminous, and contains pus.

Vasectomy performed, September 19, 1897, under local anæsthesia. September 29, 1897, no improvement since operation. Patient thinks passage of urine is easier than before. General condition is fair. October 2, 1897, discharged.

(167) Ibid. University Hospital, No. 2100. J. D., aged fifty-seven; machinist. Two years ago urination began to be difficult, the act being slow and frequent, and painful urination developed; was catheterized for the first time three weeks ago, and since has been in medical wards. Passes small quantity with slow dribbling stream by straining every one and a half to two hours. Prostate about the size of a lemon, moderately dense, smooth, and uniformly enlarged. Length of the urethra, eight inches.

Vasectomy, November 1, 1897. November 23, 1897, wound healed. November 28, 1897, discharged. Prostate shrinking. Residual urine, three ounces.

(168) Ibid. University Hospital, No. 2117. N. A. J., aged fifty-eight; manufacturer. Slight frequency and difficulty in urination began ten or

twelve years ago, and gradually increased until now he urinates (always naturally) every two or four hours. During the past year has had some pain at neck of bladder and mucous sediment and occasional ammoniacal odor in urine. Urine has never been affected nor health impaired. Length of urethra, eight and three-quarters inches; residual urine, nine ounces.

Vasectomy, December 3, 1897. December 9, 1897, discharged; wound healed; prostate much smaller. Length of urethra, nine and a quarter inches; residual urine, four ounces.

(169) Ibid. University Hospital, No. 2189. L. E., aged sixty; salesman. Frequent urination began three years ago, first noticed at night, and has gradually increased, with some straining, until five days ago, when he was seized with sudden and complete retention, which was relieved by catheterization. Three days ago retention again occurred, followed by an unsuccessful attmpt at catheterization and dribbling of urine. Prostate about the size of an orange.

Vasectomy, January 19, 1898. February 11, 1898, discharged. Prostate sensibly reduced in size. Residual urine, one to two ounces. Patient requires self-catheterization once daily only.

(170) Ibid. University Hospital, No. 2239. G. G., aged sixty-nine; farmer. Frequent urination began two or three years ago, and has gradually increased until now he urinates five to eight times a day and once or twice during the night, with some straining and occasional sense of obstruction; has used a linen catheter on a few occasions. Nocturnal erections lately.

Vasectomy, March 2, 1898. March 6, 1898, union by first intention. Unusual induration over left side. March 8, 1898, discharged. Urination less frequent and of larger volume, May 3, 1898. Under this date the patient writes "I am active and in good condition. The night conflict is not now burdensome. The water regulates itself half a dozen times a day."

(171) Ibid. University Hospital, No. 2386. H. T. C., aged seventy; sea captain. Four or five years ago began to have straining and frequency of urination once or twice a night and three or four times during the day. His condition continued with but slight increase until five or six weeks ago, when, after sleeping in a damp place, he was seized with retention, and since then he has had to be catheterized twice daily. Urine has also become infected. Urine showed one-third albumen, many blood- and pus-cells.

Vasectomy, October 19, 1898. October 20, 1898, acute urethritis accidentally set up by mistake of nurse in mixing alcohol with carbolized oil. November 13, 1898, discharged. Residual urine, five ounces. Urethritis disappeared. Marked improvement. Catheterized and irrigated twice daily. No bladder or urethral symptoms. Equipped with catheter outfit; two or three months later the improvement continued. Patient happy, and applied for permission to marry.

(172) Ibid. University Hospital, No. 2436. J. M. R., aged sixty-seven; retired merchant. Seven years ago began to have frequency of urination; at first at irregular intervals, but during past two or three years it has been chronic and associated with straining, dribbling, and

inability to entirely empty bladder. Has been using catheter (painfully) almost continuously three times during day and three times at night for the past eighteen months, as attempt to void naturally would only result in dribbling. Urine and health unaffected. Urine contained some pus-cells. Length of urethra, eight and a half inches. Prostate probably double the normal size.

Vasectomy, November 22, 1898. November 30, 1898, discharged from hospital. Voids small amount of urine, three ounces in twenty-four hours, naturally; catheterization twice daily, less painful and less frequent, especially at night.

(173) Ibid. University Hospital, No. 2597. H. P., aged sixty-four; commercial traveller. Too frequent urination for over thirty-five years, more marked during the past ten or twelve years, and twelve to sixteen times in twenty-four hours during the past three or four years, with slow and dribbling stream. Slight straining of late. No other symptoms except lessened sexual activity. Health good. No calculus. Length of the urethra, seven and three-quarters inches. Residual urine, ten ounces; prostate enlarged and moderately indurated.

Vasectomy, May 6, 1899. May 11, 1899, wound healed. May 12, 1899, discharged.

(174) Ibid. University Hospital, No. 2632. E. R., aged sixty-eight; shoemaker. Frequent urination for the past three years, gradually increasing and associated with pain and straining. Now urinates ten to twelve times during day and four to six times during the night. Pain, straining, and slow dribbling stream. Sallow complexion; some arterial sclerosis; attack of dizziness during past few weeks. Several anterior urethral strictures, ribbed bladder, slightly enlarged prostate, increased length of the urethra and prostatic curve. Six ounces of residual urine, which is albuminous. Continuous catheterization and irrigation twice daily.

Vasectomy, April 19, 1899. Continues catheter. April 27, 1899, discharged at patient's request. Urinary conditions somewhat improved, but patient remains cachectic and weak and is troubled with dyspepsia. Malignant disease of the prostate is suspected.

(175) Ibid. University Hospital, No. 2852. J. K., aged seventy-four; storekeeper. About five years ago frequency of urination began, and gradually increased and was associated with straining, until a week ago he urinated fifteen to twenty times a day, passing but a few drops at a time. Since then has been catheterized two or three times a day by the family physician. Some diarrhœa of late. Health not otherwise affected. Urine was albuminous and ammoniacal, and pus and one hyaline cast were found. Length of the urethra, ten inches; prostate gland very large and hard. Absolute retention of urine.

Vasectomy, August 4, 1897. August 5, 1897, severe chill followed by fever, 102⅝° F., last night after catheterization. Better this morning. August 9, 1897, began to pass one to one and a half ounces of urine the day after the operation, and continues to do so. Constant desire to strain; troubled with diarrhœa and restlessness. Temperature, pulse, and respiration normal. August 22, 1897, discharged. Residual urine in twelve hours,

six ounces. Diarrhœa prevented accurate measurement of urine passed spontaneously. Prostate considerably reduced in size.

November 18, 1898, readmitted. Some relief experienced from the operation for several weeks, and then gradually relapsed, until now he is as bad or worse than before. Urine very foul. Permanent catheter put in and bladder irrigated. Capacity of bladder small. Irrigation painful. No improvement in any respect. General condition much worse. Patient taken from hospital after a few days' stay and died shortly after. Carcinoma of the prostate suspected.

(176) Ibid. University Hospital, No. 2963. M. B., aged sixty-three; merchant. Over a year ago began to have painful and frequent urination, pain being along urethra during act only. This condition gradually increased, and has been very much worse during the past six weeks, urinating a few drops every fifteen to thirty minutes, and associated with much pain and straining and double orchitis and pain and swelling of right calf and foot, which persists for two or three weeks and up to two weeks ago. Obstinately constipated; health is becoming affected, and sleeps but little owing to constant desire to urinate and overful bladder. Residual urine, five ounces; ammoniacal, pus, and trace of albumen present. Under boric acid instillations and irrigations of silver nitrate, 1-20,000 twice daily, the urine improved, and residual reduced to three ounces, and on October 17, 1899,

Vasectomy was performed. November 6, 1899, discharged. Residual urine, one ounce. Gets up only once at night. Great improvement in every way.

(177) Ibid. P. B. R., aged seventy-nine; retired railroader. About fifteen years ago began to have too frequent urination, with weakness and dribbling of stream, which condition has since gradually increased, and some straining and pain when urination is delayed. Began to use catheter eight or ten years ago and at irregular intervals since, the last time being about eight months ago, when its passage caused an unusual amount of urethral pain, and was followed by bleeding, which latter, previously confined to catheterization, has since occurred at irregular intervals on naturally passing urine. Used to have to urinate several times during the night, but during past three or four years the total quantity of urine has decreased, so that now he urinates about six times during the day only, a small quantity each time, and has to make several attempts before satisfactorily emptying the bladder. Urine has been foul, dark, thick, and scanty for some time. Vesical searcher could not be passed through the prostatic urethra. Residual urine, two ounces. Prostate moderately enlarged, soft, and tender. Great number of hæmorrhoidal masses protruding from anus.

Vasectomy (right side), March 15, 1900, under local anæsthesia. March 18, 1900, irrigation stopped on account of discomfort and urethral bleeding. March 25, 1900, irrigated twice yesterday, followed by pain, bleeding, and tenesmus and inability to pass any instrument through prostatic urethra, until finally a metal prostatic catheter was introduced and drew off two or three ounces of bloody urine; only sixteen ounces passed

in last twenty-four hours. Metal catheter tied in. Patient perspiring freely; pulse 106; temperature normal. Appears dull and sleepless; tongue brown coated. March 27, 1900, tenesmus continues; metal catheter removed and linen catheter easily introduced and kept in with less discomfort. March 31, 1900, general improvement in every way; catheter still in. Is bright and passing more urine, forty-four ounces, for last twenty-four hours. The patient continued to improve after returning to his home.

(178) Ibid. University Hospital, No. 3126. W. L., aged sixty-nine; U. S. Army. About ten years ago he began to urinate too freely. Five years ago he urinated twice during the night and four or five times during the day. No pain. No marked change until November, 1898, when, during an attack of la grippe, he began to have spasmodic pain at neck of bladder; relieved by urination and some straining. Urination became more frequent, and he was irregularly catheterized by physician until January, 1899, since which time he has catheterized himself about five times daily, thus always relieving spasmodic pain at neck of bladder. Urine has smarted at times, but never foul. About six weeks ago right testicle became inflamed and remained so for a time, and some swelling still persists. Considerable difficulty in introducing No. 15 French catheter in both penile and prostatic urethra, worse in latter, and discomfort. Tenesmus and some balanitis. Five ounces withdrawn. No calculus.

Vasectomy, January 17, 1900. January 22, 1900, permanent catheterization. Patient dull mentally since operation. January 24, 1900, becoming slightly delirious; catheter removed. January 27, 1900, delirious all the time now. Temperature, pulse, and respiration were normal. Forty-five ounces of urine in twenty-four hours. Catheterization is difficult, a prostatic catheter having to be used. January 29, 1900, wildly delirious; is passing about four to five ounces naturally. February 1, 1900, fell over dead. Various drugs have been used in course of case, pilocarpin, diuretin, prostatic extract. Autopsy showed carcinoma of prostate, secondary deposits, brown atrophy of heart, chronic nephritis, etc.

(179) Wood, A. C. University Hospital, No. 2045. Mr. K., aged seventy-two; prostatism.

Vasectomy, June 26, 1897, without anæsthesia of any kind. July 5, 1897, the patient's memory does not seem good. July 9, 1897, the patient discharged. The catheter seemed to pass rather more easily, but otherwise there was no change.

(180) Ibid. University Hospital, No. 2064. Mr. K., aged seventy-four; had complete retention, and was in feeble health.

Vasectomy, August 4, 1897. Patient began to pass a little urine the day after the operation; prostate appeared to shrink somewhat. The patient was somewhat apathetic during convalesence, but this passed off, and he was able to entirely dispense with the catheter for a long time. June, 1898, his physician reports that the former symptoms are returning. He intends to report again for advice.

(181) Ibid. University Hospital, No. 2076. Mr. Y., aged fifty; prostatism.

Vasectomy, September 19, 1897. Ten days later, the patient says he passes urine with greater ease, but otherwise there is no improvement to note.

(182) Ibid. Philadelphia Hospital. P. K., aged sixty-eight; absolute retention since May, 1897; systematic catheterization, irrigation, etc., was carried out without benefit. Patient is dull and complains of severe pain in the bladder.

Vasectomy, June 5, 1897. The patient passed a little urine the same evening. The next day there was only one ounce of residual urine; subsequently all of the urine was passed spontaneously. June 9, 1897, the patient was sitting up in bed; he looks ten years younger. There was a real transformation in his expression.

(183) Ibid. W. M., aged sixty-four; prostatism. Vasectomy. Condition unchanged.

(184) Ibid. University Hospital, No. 2367. J. H. G., aged fifty-eight; has had frequent and painful urination for a long time (patient very deaf); during past few weeks he has been unable to retain any urine in bladder, two ounces causing intense pain. He has been in the habit of catheterizing himself, but lately had retained catheter in urethra continually. Good general health.

Vasectomy, September 10, 1898. Both cords resected and the ends sewed in the margin of the wound with catgut. Permanent catheterization. September 20, 1898, discharged. Catheter removed. Condition much improved. Although still unable to void urine naturally, he can hold it four hours without pain.

(185-192) Woodarz (*Zeitschrift für praktische Aerzte,* No. 9, 1898) described seven cases of vasectomy for enlarged prostate operated upon in the Breslauer-Allerheiligen Hospital. Six cases were cured. The time in which the catheter could be dispensed with after operation varied between seventeen days and three months. The chronic cystitis was improved in all the cases. One of the cured cases died four months after operation of pneumonia. Neither the testicles nor the prostate showed any change, either macroscopically or microscopically. (No fatty degeneration of the epithelium.)

(193) Zuckerkandl, O. (*Wien. klin. Rundschau,* 27, 1896). Patient, aged seventy, was operated upon by lithotrity two years before the present report. Some months later dysuria and retention appeared. Catheter could not be used. Bladder was punctured and a fistula established. The urethra remained impermeable.

Vasectomy. The following day the patient passed urine with much more ease. On the fifth day there were but a few grammes of residual urine, and at the end of some days later none whatever. Prostate diminished in size one-third. The urine was acid and clear.

MASSAGE IN THE TREATMENT OF RECENT PERI-ARTICULAR FRACTURES.[1]

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THREE years ago, I read a paper before the Surgical Section of the New York Academy of Medicine on "Massage in the Treatment of Fractures,"[2] giving a preliminary report on the cases so treated. I had commenced the trial of the method over a year before, after reading Lucas Championnière's book[3] on the subject. I was led to the use of the method by the feeling that, in spite of the great advances made in other branches of surgery, little, if any, had been made for a generation in the treatment of fractures, and that the results of the present orthodox treatment were oftentimes decidedly unsatisfactory, especially in periarticular fractures.

The advantages claimed for the treatment by massage were certainly striking, and, if borne out in practice, would be a great advance on the ordinary method of treatment. Some of these advantages were, shortening of the time of repair by one-third and of functional use by one-half or more, the avoidance of stiff joints, atrophied muscles, obstructed circulation, etc.

The idea of massage and mobilization is so diametrically opposed to that of immobilization that a brief repetition of the statements of Championnière relative to the two methods of

[1] Read before the New York Surgical Society, April 25, 1900.

[2] Medical News, New York, March 20, 1897.

[3] Traitement des fractures par le massage et la mobilization.

treatment may not be out of place. He claims that immobilization (1) relieves only the primary pain due to the movements of the fractured ends on one another, and allows or favors the secondary pain due to swelling of the surrounding parts. (2) It only imperfectly restores the original form of the part, especially in fractures near joints, when the swelling may reproduce the deformity. (3) It does not favor the repair of bone or the restoration of function, but, on the contrary, causes scantiness of callus,—sometimes the cause of delayed union or non-union,—and results in stiffness of the neighboring joints, atrophy of the muscles of the limb, and disturbances of the circulation which require time and patience to overcome.

On the other hand, he claims that a certain amount of motion is favorable to the repair of bone, and that massage, in addition to furnishing this, prevents atrophy of the muscles, reduces swelling, and restores the circulation. In this and other less clearly known ways it causes the repair of bone to be rapid and, in combination with passive motion, prevents the stiffness of the neighboring joints.

Apart from the fact, shown by M. Canay's experiments, that fractures in dogs treated by immobilization in splints do not heal, we have the well-known facts that of all fractures in human subjects those of the ribs, in which complete immobilization is impossible, heal most surely, and that in cases of delayed union we employ movement to bring about union.

Certain contraindications are admitted by Championnière, such as the compounding of fractures, the presence of large blebs or a projecting fragment, great mobility, and the tendency of the deformity to be reproduced. It is unnecessary to repeat here the description of the method of the application of massage which I have given in the paper alluded to.

In fractures of the shafts of the long bones of the extremities, we have an improvement on the older methods in the ambulatory splint, by the use of which the atrophy of the distant muscles, as those of the thigh in a case of fracture of the leg, is prevented, and the general condition and the circulation are improved by not confining the patient to bed. The

joints, too, though stiff at first and requiring massage and passive motion to make them supple again, readily yield to such treatment when they are neither injured nor in close proximity to an injury.

Certain fractures, especially the oblique fractures of both bones or the only bone of a limb, require a retentive apparatus to prevent the sliding by or longitudinal displacement of the fragments, and thus are not suitable to massage until some consolidation has occurred, requiring ten days to three weeks. When one bone of the arm or leg is fractured and is splinted by the other bone, massage may be applied in most cases from an early date. But it is in the common periarticular fractures that the method of immobilization gives the worst functional results; although it may be improved, but often not entirely relieved, by after treatment. Fractures of the shafts of the long bones I have treated for the most part by methods in common use. It was in these periarticular fractures, of which we have a common example in Pott's fractures of the ankle among hospital interne patients, that it seemed to me the need of improvement in treatment was most called for. The application that I have made of the massage treatment has been largely with Pott's fractures of the ankle, of which I have more or less complete notes of forty-seven cases. I have not treated all cases of Pott's fracture by this method, nor have all the cases in which it was used been treated exactly alike.

In the first place, I have seen no reason for discarding splints or retentive apparatus between the applications of massage before the patient is allowed up. In fact, it gives a greater sense of security to the patient as well as to the surgeon to feel that in the intervals between the application of massage displacement of the fragments is prevented by a splint. The casting aside of splints in connection with massage treatment by Championnière is the act of an enthusiast in a new method discarding the paraphernalia of the old. In none of the cases of Pott's fracture treated by massage has the splint been regularly discarded before the patient is allowed up. A Volkmann splint is the kind usually employed. It is evident from the mechanics of the foot that any deviation from the normal posi-

tion is incompatible with normal function. Hence, a chief aim should be to put and keep a Pott's fracture in the best possible position. So important do I consider this, that if, on account of free posterior displacement or lateral mobility, the ankle cannot be or is not kept in good position by the splints used between the periods of massage, I do not hesitate to put it up at once in plaster. This may be necessary at the outset for the first ten days or more, or after massage has been applied for a time. Our zeal to prevent stiffness should not lead us to disregard the position of the parts or to cause non-union. That the latter is possible from too vigorous passive motion, I am quite sure. I have seen it twice, in two consecutive cases, during the past winter after massage had been used for three weeks, and when the passive motion had probably been too vigorous, as I had insisted on its importance in obtaining a good functional result. It should be begun and increased cautiously and applied carefully. As far as the functional result is concerned, I have found it far better to put up in plaster first and massage afterwards, than the reverse. In cases treated by plaster for ten days or so and then massaged, the result is nearly as good and as speedily obtained as in those cases massaged from the first, while in those cases first massaged for one to three weeks and then put up in plaster for two weeks, the stiffness of the joints and atrophy of the muscles are well marked when the plaster is taken off, though not as extreme as when the limb is kept in plaster from the first. In my list of forty-seven cases of Pott's fracture the time of commencement of massage after receipt of the injury is mentioned in forty-three cases, and ranged from at once to seventeen days, averaging three days after the injury. At the time of writing my former paper, most of the literature on the subject was confined to French and German sources. In looking over the literature since that date, several reports are to be found in English and American journals. The reports of those who have given the method a trial is entirely favorable so far as my investigations have gone. It is natural to expect that Championnière, the method's most enthusiastic advocate, would go farther than many of his followers in the general application

of the method. It is interesting to note the limitations many apply to its application. Thus, among Championnière's Parisian colleagues, Péan,[1] confirming the excellence of the results obtained, thought the method especially useful when there was not great displacement, and Labbé [1] in periarticular fractures. The *Lancet* (London) editorially remarks that "if massage is exalted into the chief place in the treatment of fractures, and correction of displacement is regarded as of only minor importance, we fear its wider employment will be attended with much harm." It then adds, "of all the evil consequences of fractures of the bones of the limbs none is more common or more painful than the stiffness which is so often met with." Caldwell [2] thinks it most applicable to fractures in the vicinity of joints and in fractures of the clavicle. Angelesco [3] does not massage fractures with displacement until after fifteen to twenty days, and Buscarlet [4] often leaves fractures immobilized ten to twenty days. As to the results, Gould [5] says truly that "the real standard by which we ought to judge our results is the perfection of function of the part." Miller, using the massage treatment at the Edinburgh Royal Infirmary, reports that the object is mainly to prevent stiffness after union, and so to save time for the patient, which amounts to two weeks at the minimum. Angelesco finds that callus is regularly formed, but not excessive; that massage prevents excessive callus, and that in fit cases it gives incontestibly better results than immobilization. In his experience, Pott's fractures require twenty-eight to thirty days for complete consolidation and normal function. Bennett finds the same period of time sufficient in fractures of both bones of the leg. He also finds that massage relieves the muscular spasm so common and so distressing in the early stages of fractures, and which may render impossible the relation of the fragments in any proper position. Passive motion, he says, in addition to preventing

[1] Bull. Acad. de Méd., Paris, 1897, iii, S. xxxviii, 678-685 and 695-698.
[2] Railway Surgeon, 1898.
[3] Arch. d. Soc. Méd. de Bucarest, Paris, 1897, ii, 207-213.
[4] Rev. Méd. de la Suisse Rom., Geneva, 1897, xvii, 752-755.
[5] Lancet, London, 1897, i, 1599-1602.

stiffness of the joints, causes an "internal massage by the movement of the muscles and tendons, especially about the fracture." The objections to the method he characterizes as of no surgical moment, and in this I concur; but it is proper to mention some of them. For hospital patients, from the point of view of the hospital, more time is required than if the fracture cases are at once sent out with plaster splints; but from the point of view of the patients much time is gained in union of the fracture, and especially in the functional use of the limb. It has been suggested that non-union would be more common, but the opposite is the universal judgment of those who have tried it, who find that union is more speedy and firm. It is true that, as Miller found in one case, the deformity of a Pott's fracture may reoccur from too early and free use of the leg in walking, and it is wise to exercise some caution and supervision until union is firm at the end of the fourth week. Of course, it is not equally applicable to each case, and every case must be judged by itself.

The question of expense has been raised as an objection to the treatment by massage. Undoubtedly, it requires the more frequent attendance of the surgeon during the first four weeks; but then the need of his services should be unnecessary, and the time and better functional result gained by the patient, as well as the avoidance of the long-continued after-treatment to relieve stiffness, atrophy, etc., more than counterbalance the greater initial expense, in my opinion. To be sure, a very busy surgeon might find the time required an objection, but one easily overcome by employing an assistant, and only supervising the treatment himself.

In the forty-seven cases of Pott's fracture in which I have observed the effects of the treatment by massage, the age ranged from seventeen to sixty years, and averaged thirty-six years. More or less posterior displacement was noted in twelve cases, and lateral displacement in seven cases. One case treated last winter had most extreme lateral displacement, but, as it was readily kept reduced, massage was employed with an excellent result. In eight cases splints or plaster were employed for from four to seventeen days before massage was

commenced. In one case massage was used for twelve days, then plaster for twenty days, and then again massage; while in four cases plaster was applied after three weeks of massage, in two for faulty position, and in two for non-union. The results have been excellent. Save one discharged improved at his own request at an early date, all have been cured after a treatment in the hospital averaging twenty-five days and a fraction over. As a rule, the histories simply state that the patient was discharged cured, but in fourteen good bony union is noted, in ten cases "no deformity," in eighteen perfect motion, and in five a slight limp. It is interesting to note the date of first being allowed up out of bed. This averaged nineteen and three-quarters days after the injury, and ranged between a couple of weeks and thirty-three days. Of course, when first allowed up, they walked on crutches, and then with canes, a varying length of time, depending upon the condition at the seat of fracture, and the time elapsed after the injury. Exceptionally cases allowed up on the twentieth or twenty-first day have walked off at once without support or limp. I think, however, that there is danger in letting them walk too freely without support at an early date. These results have been obtained by massage applied largely by the male and female nurses of Bellevue Hospital, and in spite of the fact that as they change from year to year none become as expert as if they continued to apply it from year to year.

In fracture of the patella, I know of no treatment for general use which yields better results as to union and function than massage combined with elastic compression at first, and passive motion later. One case so treated was discharged in twenty-four days with firm union and almost perfect motion, and when shown, five weeks after the injury, to the Surgical Section of the New York Academy of Medicine, the union was apparently bony and the function perfect. In none of the other four or five cases similarly treated have the results been quite so remarkable, but they compare more than favorably with that obtained by other methods. In the last case thus treated refracture occurred after several weeks, while the

patient was trying to kick a cat, and the fragments were then sutured.

There are perhaps no articular and periarticular fractures in which the functional results are likely to be as bad as in fractures into or near the elbow-joint. I have treated some of these fractures, including those of the olecranon, by massage and passive motion with such good results that I am convinced that it is by far the best method for these bad cases.

In Colles's fractures of the radius, the conditions are especially favorable to treatment by massage, and the results uniformly good after its use. These cases may be treated without splints from the first, with only a bandage around the wrist. When so treated, the functional results are said to be perfect, and, though some deformity may persist, it is not greater than after the splint treatment. Personally, I see no reason why we should omit the attempt to reduce any bony deformity in these fractures, and employ retentive splints for the first week or ten days.

Although I have used massage in treating fractures of the neck of the femur, especially to overcome muscular spasm, I have not used it systematically as the only treatment. Each case must be judged by itself, and in many the ambulatory method seems theoretically best suited, though often not easy of application. I refer to the alcoholic and aged in whom confinement to bed is detrimental. I have also noted the good effect of treatment by massage in a few cases of fractures near or involving the knee- and shoulder-joints.

Finally, though I have applied the massage treatment principally to periarticular fractures for the reasons given above, I have also found it equally successful in a limited number of fractures of the shafts of the long bones where there was no great amount of deformity.

Why, then, is not this method more extensively used? Several factors may help to explain it. The traditional belief in the necessity for complete rest and immobilization does not appear at first sight consistent with massage. The impression on the part of the laity that the surgeon is responsible for a perfect result in the treatment of fractures, has resulted in

malpractice suits being more common on account of a poor functional result after a fracture than in any or perhaps all other branches of surgery. Hence, surgeons are ultra-conservative and slow in adopting any but the stereotyped methods of treatment; whereas, I am firmly convinced, the very thing patients desire most, a good functional result, can be more safely assured in cases treated by early massage and passive motion.

In conclusion, I may say that with an increased and increasing experience I am more than ever satisfied with the results of this method, and can more conscientiously and warmly advocate its more extended use. As stated before, I see no advantage in discarding splints in the early period of the treatment. Their use gives confidence to the patient and the surgeon alike, and a sense of security that no displacement is likely to occur. We should pay particular attention to the position of the limb by carefully reducing any deformity, and keeping it reduced during massage and between the periods of massage, when the limb is in a splint. If this is not possible from the outset, after a preliminary massage, plaster should be applied, and kept on for from eight to fourteen days, and then massage commenced. The result in these cases is better as far as position is concerned, equally good functionally, and nearly, if not quite, as quickly obtained as when massage is employed from the first. If, again, after massaging for some time, the position is found to be imperfect, or if, after three weeks, quite firm union has not taken place, I believe in using a plaster splint for eight to fourteen days, though the functional result is thereby delayed.

The application of massage and passive motion is easy. It relieves pain and swelling, hastens callus formation and solidification, and prevents atrophy of the muscles and stiffness of the joints and tendons.

With the above restrictions on the practice of Championnière, I believe that the treatment of fractures, especially articular and periarticular fractures, by massage and passive motion gives the best and quickest result as to bony union and function of any method of treatment in vogue.

EXCISION OF THE WRIST BY A MODIFICATION OF MYNTER'S METHOD.[1]

By WILLIAM J. TAYLOR, M.D.,

OF PHILADELPHIA.

At the eighth session of the American Orthopædic Association, held in Washington in 1894, Dr. Hermann Mynter, of Buffalo, read a paper upon excision of the wrist-joint by a new method, and described in detail an operation which he had performed some months before. This method had been suggested by Professor Studsgaard, of Copenhagen, in 1891, and consisted in making a longitudinal incision between the third and fourth metacarpal bones, and thus opening up the wrist-joint between the os magnum and unciform bones and between the semilunar and cuneiform bones. Both the superficial and deep palmar arches were cut, but easily ligated, in the wound. Dr. Mynter stated that he did not know whether this suggestion had been acted upon before, but that three months previously he had operated by this method upon a woman, aged thirty-five, with tubercular osteitis of the carpus. He made a slight change in the original proposition of Professor Studsgaard, however, in splitting the hand between the second and third metacarpal bones, and thus entering the wrist between the trapezoid and os magnum and between the scaphoid and semilunar bones, as by this incision the hand was more evenly divided. The dorsal incision reached up to the radius, and the palmar incision did not extend farther than the base of the thenar of the thumb. The annual volar ligament was, therefore, not severed. His description of the operation, and the ease with which the bones of the carpus could be extirpated with the scissors as well as the surfaces of the radius, ulna,

[1] Read before the Philadelphia Academy of Surgery, January, 1900.



FIG. 1.—Tuberculosis of carpus. Skiagraph made just before operation of excision.



FIG. 2.—Skiagraph showing condition three months after excision of carpus for tuberculosis.

and metacarpal bones by a small saw, made a very lasting impression upon me, and I decided to employ this method at the first opportunity.

Dr. Mynter tells me in a letter dated October 21, 1899, that he has performed this operation twice since with perfect results; but these cases have not been published. He makes the statement that he splits the palmar surface only to the neighborhood of the superficial arch, and does not sever either arches nor open the palmar bursa.

I have tested this method in the following instance:

The patient is thirty-two years of age and a motor-man by occupation. The family history is good, with the exception that his father died of necrosis of the bones of the face. He had had the ordinary diseases of childhood, and when twelve years of age an abscess in the knee. Two years ago he had rheumatism. Shortly after this he noticed an abscess in his left shoulder, which finally discharged at two places on the arm; both these openings gradually closed, and now, beyond some scars, there is nothing remaining except an almost complete ankylosis of the left shoulder-joint. About two years ago he first began to have pain in the right wrist-joint, but he kept at work for nearly a year, the pain at times being better and at other times worse.

When I first saw him in September, the wrist was swollen and very painful, and had the appearance of typical tubercular arthritis of the wrist-joint. The fingers of the hand were stiff from inflammatory adhesions. He was admitted to the wards in the Orthopædic Hospital, September 20, 1899, and discharged October 21, 1899.

After placing him under the influence of ether and with the hand elevated, an Esmarch bandage was passed around the limb above the elbow, which effectively controlled the circulation. I made an incision upon the dorsum of the hand, extending from the radius downward between the second and third fingers, and split the hand and wrist, but exercised the greatest care not to carry my incision to the deeper tissues of the palm of the hand, nor to incise the sheath of the flexor tendons nor of the palm fascia. Neither of the palmar arches were cut, as I wished, if possible, not to make the palmar incision, and thus destroy the strength of the hand itself. I was astonished to see the facility

with which the wrist-joint could be exposed, and also to see that no tendons whatever were divided by this incision, except one tendon attached to the carpus itself. I was enabled to clean out all of the bones of the wrist, cut away the end of the ulna and radius with a saw, as well as the proximal ends of the metacarpal bones, and with scissors I was able to cut away a large amount of gelatinoid and tubercular tissue from the sheath of the tendons and intermuscular spaces. There was no need, whatever, for splitting the hand farther than this, and the operation was done



FIG. 3.—Photograph of anterior surface of wrist three months after excision of carpus for tuberculosis.



FIG. 4.—Photograph of posterior surface of wrist three months after excision of carpus for tuberculosis.

with as great ease and in as full view as an excision of the knee-joint.

The wound in the skin brought together with silkworm sutures, the tissues having first been brought together with cat-gut, and the dead space between the bones of the wrist and of the hand was packed with iodoform gauze. This was removed in three days, and a small amount of packing kept up at intervals until the wound entirely healed, which was in the course of about

three weeks. The hand, of course, was kept upon a splint. I regret very much at the time of operation I did not break up all of the adhesions in the fingers, as, since that time, we have had a great deal of trouble in overcoming this stiffness in the tendons and in the finger-joints themselves. I had a skiagraph taken of the hand before operation, as well as a skiagraph of the hand since the wound has been entirely healed. The result is most excellent. I do not think, without some such incision, it would have been possible to have gotten rid of the whole of the tuberculous bone, certainly neither Lister's nor any of the older operations would have accomplished the desired end so readily.

While he was in the hospital he complained of a great deal of cough, which was relieved by creosote, as well as of a painful swelling just to the left of the sternum over the third rib. After he left the hospital, this pain and discomfort continued and the swelling increased. He was again admitted to the hospital, ether given, a good-sized cold abscess opened, and a sinus found which extended out towards the left shoulder; this was thoroughly curetted and packed, and this wound is now about well. When he was under ether for this operation, opportunity was taken to break up the adhesions in his fingers, and, although they are still very stiff, considerable progress has been made.

The accompanying skiagraphs and photographs were taken by Dr. D. F. Weeks, the resident surgeon.

THE ILEOCÆCAL ORIFICE AND ITS BEARING ON CHRONIC CONSTIPATION, WITH REPORT OF TWO CASES RELIEVED BY OPERATION.[1]

By WILLIAM J. MAYO, A.M., M.D.,

OF ROCHESTER, MINN.

Miss E. V., aged twenty-one, was admitted to St. Mary's Hospital, Rochester, Minn., on August 14, 1899, with the following history:

She has been obstinately constipated since a child. This condition has increased with years, and now requires the use of a large amount of laxative to secure a fæcal movement. For a year or more has suffered from pain in the region of the appendix, which is much aggravated by the use of the necessary remedies for the relief of the constipation. At times this right-sided pain confines her to her bed for several days.

Examination.—A strongly-built girl of 140 pounds in weight, general appearance anæmic, color pale, tongue coated. No evidences of disease beyond a soreness in the region of the cæcum and some muscular rigidity at this place.

On the history of the obstinate constipation, the attacks of right-sided pain lasting several days at a time, and the local tenderness, a diagnosis of chronic appendicitis seemed reasonable, and on August 16 the appendix was removed. There were a few adhesions about the appendix, but not enough evidences of disease to account for the symptoms. It was noticed at this time that the small bowel was quite full of material in spite of the previous energetic purgation. At the junction of the ileum and cæcum the calibre was reduced markedly, having almost the appearance of having a string tied around it sufficiently tight to reduce the lumen one-third. There were no evidences of previous ulcera-

[1] Read before the Olmsted County Medical Society, March 6, 1900.

tion nor disease. Nothing further was done at this time. Following the operation no improvement in the constipation took place, nor was there any marked relief to the symptoms. December 29, 1899, the patient was readmitted to St. Mary's Hospital, and the ileocæcal coil exposed. An incision was made two and one-half inches in length at right angles to the ileocæcal juncture, having its centre at that point. The wound was sutured transversely, after the manner of the Heineke-Mikulicz pyloroplasty, making a very considerable increase in the size of the aperture between the ileum and cæcum.

The bowels now act regularly or with slight aid and in marked contrast to the previous condition. The pain and tenderness have disappeared and the general condition has vastly improved.

The time which has elapsed is too short to give this case much value, and my purpose in reporting it is to call attention to some facts which a superficial investigation of the subject has brought forth, and to some deductions from the facts which may be and probably are true.

The literature bearing on the subject as to the function of the ileocæcal valve is meagre. It seems to be taken for granted that its main purpose is to prevent the return of material of any kind from the large into the small bowel, and there is no doubt that this is one of its functions. The ileocæcal valves consist of two semilunar folds of mucous membrane situated one superiorly and the other inferiorly, leaving a transverse slit between at the point of junction of the ileum and cæcum. On one side of the valve is the mucous membrane of the small bowel, on the other that of the large intestine. Immediately at the base of the valves is a circular fold of muscle fibres forming a constrictor muscle having much the appearance of the pylorus. The mechanism of the ileocæcal opening certainly bears out the view that one of its main functions is to prevent the too rapid emptying of the small bowel, and to maintain some pressure against peristalsis until the process of small bowel digestion is properly completed. It naturally follows that if for any reason the barrier to ready egress be excessive,

partial retention of small bowel contents takes place, and a small bowel constipation, so to speak, with a resulting train of symptoms due to fermentation and absorption, necessarily results.

The slow delivery of the intestinal contents into the large bowel, and perhaps in a condition changed from the normal, predisposes to constipation, the large bowel being indirectly rather than directly at fault.

There is no means at present of estimating the effect on intestinal digestion of partial obstruction, and especially so in a minor degree; yet, if we look at the effects of even slight obstructions at orifices having a similar function, such as the outlet of the stomach, urinary bladder, etc., we cannot but be struck with the remarkable similarity in results,—a more or less painful excretion.

The secretions in the small bowel are alkaline, in the large bowel slightly acid, and in the production of this change gases are evolved which materially aid the passage of fæcal matter along the large bowel. The thinness of the muscular coat of the large bowel and its sacculation make it evident that flatus is a necessary adjunct to fæcal progress. It becomes a question, also, as to whether or not the greater amount of absorption which takes place in the small bowel under such circumstances leaves the contents, when passed, in a condition less favorable to stimulate the peristalsis and production of gases in the large bowel. The writer has in eight cases eliminated the ileocæcal mechanism as a factor in the intestinal circulation either by removing the parts for malignant or tubercular disease or by an ileocolostomy, and in each instance the bowel movement became looser and more frequent than had been the habit of the individual previous to the advent of the disease for the relief of which the operation was undertaken; showing that, if the ileocæcal valves are not present, the fæcal circulation in the large bowel is rendered more active.

In going over the anatomy of this region and in a few dissections, I have noticed that the terminal portion of the ileum comes upward out of the small pelvis, forming some-

what of an acute angle near its insertion into the cæcum. The mesentery of the ileocæcal coil being of good length, but at a point just above this portion of the lower ileum, the mesentery is shorter; and it is in this lower portion of the ileum that typhoid perforations are most common, and this question of the vulnerability of the lower ileum to infectious processes brings up at once the important point: What will be the effect of enlarging the orifice in permitting a freer communication between the bacteria in the large and small bowel, especially the colon group? So far as I am able to learn in the few cases in which this has been done for diseased processes, no harmful effect has been noted.

Since I have had this subject in mind, I have examined with some care the ileocæcal coil in the course of a number of abdominal operations to see if there was any ready way of estimating the size of the ileocæcal orifice. In most cases an inspection will reveal any marked abnormality. Some information can be gained by causing the finger to invaginate the wall of the ileum into the cæcum, and in a few cases the cæcum into the ileum in a manner similar to the process of invaginating the finger against the scrotum into the external hernial ring.

I had an opportunity to repeat the operation on an inmate of the Rochester State Hospital for the Insane. The history of this case is briefly as follows:

Miss L. C., aged twenty-five years, was admitted to the Rochester State Hospital for the Insane, November 2, 1898, suffering from melancholia. In the history of the case previous to admission, constipation of the most obstinate character was about the only symptom of physical ailment. Since in the hospital she has constantly suffered from constipation, which has required the usual remedies in large quantities, and, in spite of constant watchfulness, has had a number of attacks of obstipation. During these attacks there has been soreness in the cæcal region.

Examination.—An anæmic girl of slender physique. On pressure, a sensitiveness in the region of the appendix was apparent, with rigidity of the right rectus muscle. Abdomen was somewhat distended with gas.

The diagnosis of chronic appendicitis seemed justifiable, based on the previous attacks of pain and obstipation and the present tenderness. Exploration, February 27, 1900, revealed a normal appendix. The ileocæcal coil was drawn out and examined; the same condition was found as in case number one,—an unusual narrowing of the aperture between the small and large intestine. A plastic operation was performed similar to the previous case. An incision three inches in length was made into the lumen of the ileocæcal coil in the direction of the small intestine, having its centre at the superior valve, which it divided. This wound was closed transversely.

It is not intended in this short communication to do more than draw attention to the subject. The mere fact that two cases have been relieved of pain in the region of the cæcum and constipation by a plastic operation which enlarges the calibre of the ileocæcal opening does not warrant that any conclusions should be formulated. It is well understood that chronic constipation is ordinarily a disease of the large bowel; but I believe that there are certain cases in which an organic or functional narrowing of the ileocæcal opening is responsible for a train of symptoms of which pain in the region of the cæcum without marked disease of the appendix and chronic constipation are important symptoms.

[NOTE.—May 17, 1900. Within a few days I have examined both of these cases. The constipation in each has practically disappeared, and the general condition has greatly improved.]

HERNIA OF THE BLADDER THROUGH THE PELVIC FLOOR FROM THE TRACTION OF A SUBPERITONEAL FIBROMA.[1]

By FRANCIS B. HARRINGTON, M.D.,

OF BOSTON, MASS.,

VISITING SURGEON AT THE MASSACHUSETTS GENERAL HOSPITAL.

A SINGLE woman, forty-six years of age, came to the Vincent Hospital in January, 1899, giving the following history:

In 1893 she had been operated upon at this hospital by Dr. Ingraham for an œdematous fibroid of the left labium majus. The tumor was as large as a fœtal head. "The pedicle of the tumor apparently originated from a split or ring in the levator ani muscle close to the ascending ramus of the pubic bone." A year later the tumor began to return. In 1897 she was seen again by Dr. Ingraham for severe uterine hæmorrhage. The tumor had returned and had grown to considerable size. The uterus was curetted. It was not deemed wise to remove the labial tumor again because of the patient's anæmic condition, the result of the loss of blood.

In January, 1899, after a day of severe abdominal pain with chills and fever, she developed retention of urine, and was admitted to the Vincent Hospital under the care of Dr. Grace Wolcott, who discovered the following conditions: "The patient presents a mass pendant from the left buttock extending forward to a second smaller tumor pendant from the left labium majus. The greatest circumference of the tumor was eighteen and a half inches. On standing, the anterior portion of the tumor measured seven and a half inches in length and the posterior part eight and a half inches in length." It was impossible to introduce a stiff catheter into the bladder. A soft rubber catheter could be inserted, but the urine did not flow until it had been inserted eight inches. Pressure on the posterior larger

[1] Read at Washington, D. C., May 2, 1900, at the meeting of the American Surgical Association.

tumor when the catheter was in the bladder caused acceleration of the flow of urine. The tumor was quite painful before the urine was drawn.

The larger posterior tumor decreased in circumference two and a half inches when the bladder was emptied. Dr. Wolcott decided that the bladder was included in the larger tumor which hung between the patient's legs. I was asked to see the patient by Dr. Wolcott. On examination with the hand in the vagina, a mass could be felt passing out of the pelvis under the left half of the pubic arch and between the vaginal wall and the ramus of the pubes. It was impossible to return the mass to the pelvic cavity. The cervix uteri could be felt behind the symphysis, the body could not be made out clearly. It was evident that a portion of the bladder had escaped from the pelvic cavity, and that it was surrounded and held in this position by the tumor. The portion of the bladder in the hernia held, without discomfort to the patient, twenty-two ounces of urine. An abdominal operation seemed the most feasible method for the reduction of the hernia and the removal of the tumor. For this purpose, the patient was transferred to the Massachusetts General Hospital under my care.

On opening the abdominal cavity, the bladder seemed to be wanting, except a narrow portion which passed down through the pelvic floor on the left side between the fibres of the levator ani muscle. The uterus was in a retroverted position, the cervix being higher and nearer the symphysis than normal. This position was due to the traction of the vesico-uterine ligament and the peritoneum. The uterus was otherwise normal. There was no lateral displacement. The hand following the narrow stretched-out neck of the bladder passed through the opening in the floor of the pelvis. In this position the hand, surrounded by a sac of peritoneum, could grasp the bladder, but it was impossible to separate it from the tumor, which held it outside the pelvic cavity. The peritoneum was drawn down through the floor of the pelvis, and could be felt covering what seemed to be about one-half of the surface of the prolapsed bladder.

The attempt to reduce the hernia through the intra-abdominal route having failed, the abdominal wound was temporarily closed. An incision was then made from the tuberosity of the ischium to the upper part of the labium majus. This exposed the tissues of both the anterior and posterior tumors which arose from a com-



FIG. 1.—Photograph—Œdematous Fibroma.—Appearance from the front, patient in the recumbent position. The two tumors seen rose from a common base. The anterior smaller one started from the upper part of the left labium majus. The posterior larger growth, which surrounded the bladder, extended backward to the left buttock.

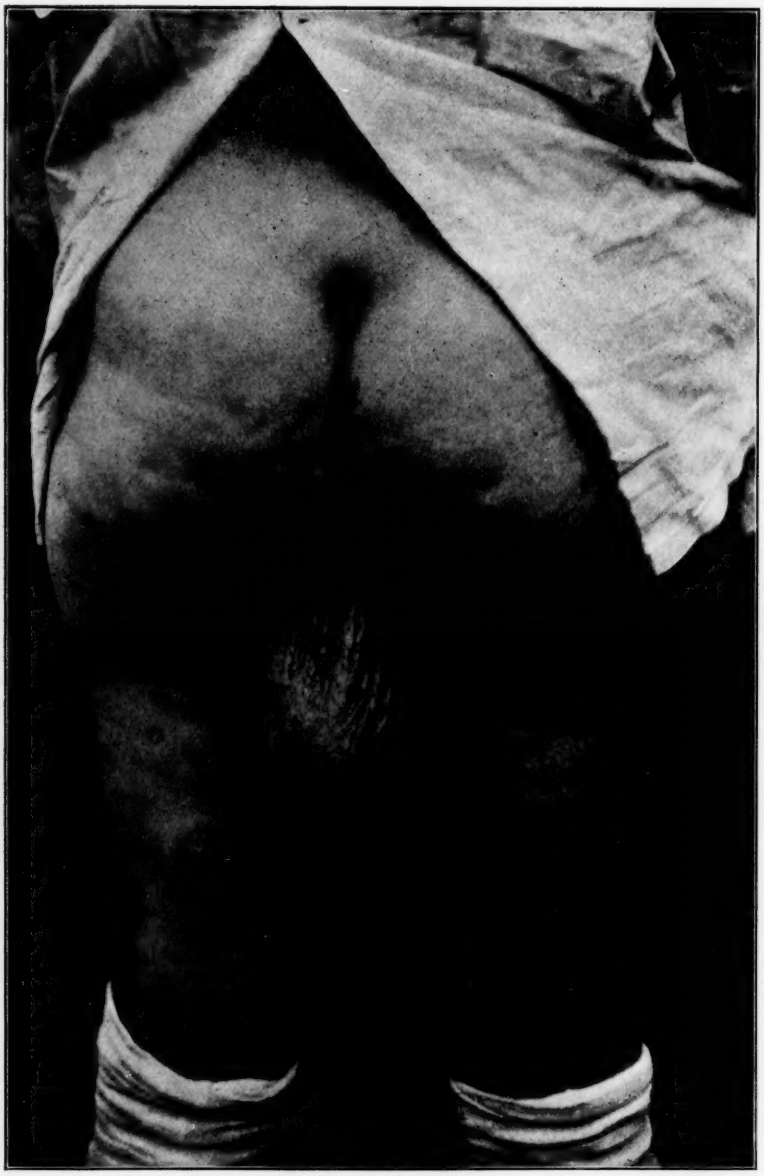


FIG. 2.—Photograph.—Appearance of the tumor from behind, patient in the erect position.

mon base. It was difficult to distinguish the bladder wall from the fibrous tissue of the tumor. The bladder was finally distended with air. This made the dissection of the tumor from the bladder wall possible. The bladder, having been separated from the tumor, was pushed back into the pelvic cavity through the open-

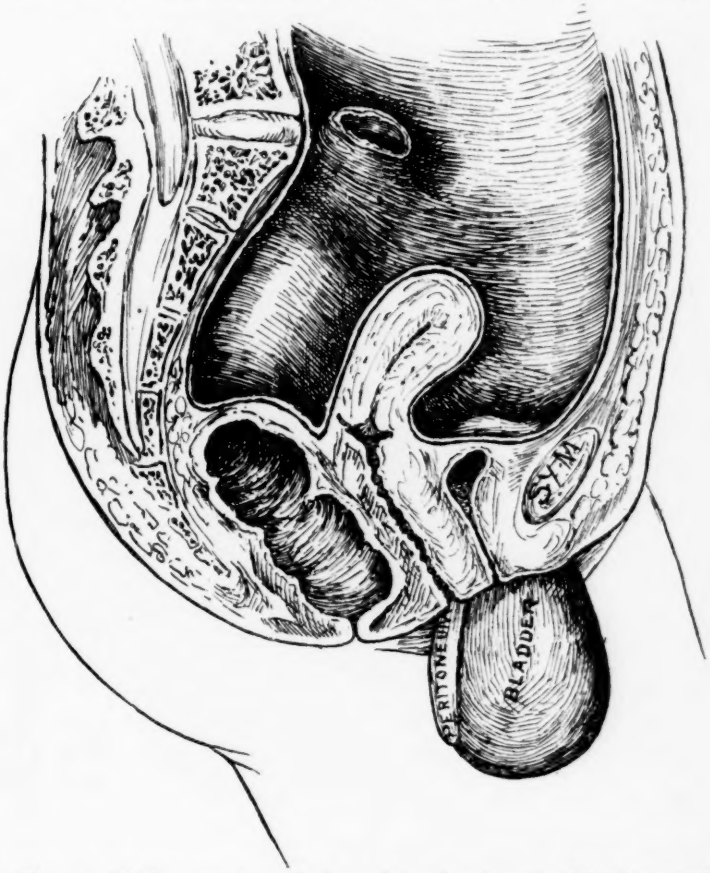


FIG. 3.—Median section of the pelvis showing the bladder passing through the pelvic floor on the left side. The neck of the bladder and the urethra have been opened by the section. The remainder of the bladder is not opened by the median incision. The peritoneum covers the left half of the bladder and cannot be seen in the figure.

ing in the pelvic floor. During the dissection the peritoneal cavity was unintentionally opened from below. The tumor itself was then cut away from its attachments to the skin and the subcutaneous tissues. The bladder showed a marked tendency to pro-

lapse through the opening in the pelvic floor, which was large enough to readily admit the hand.

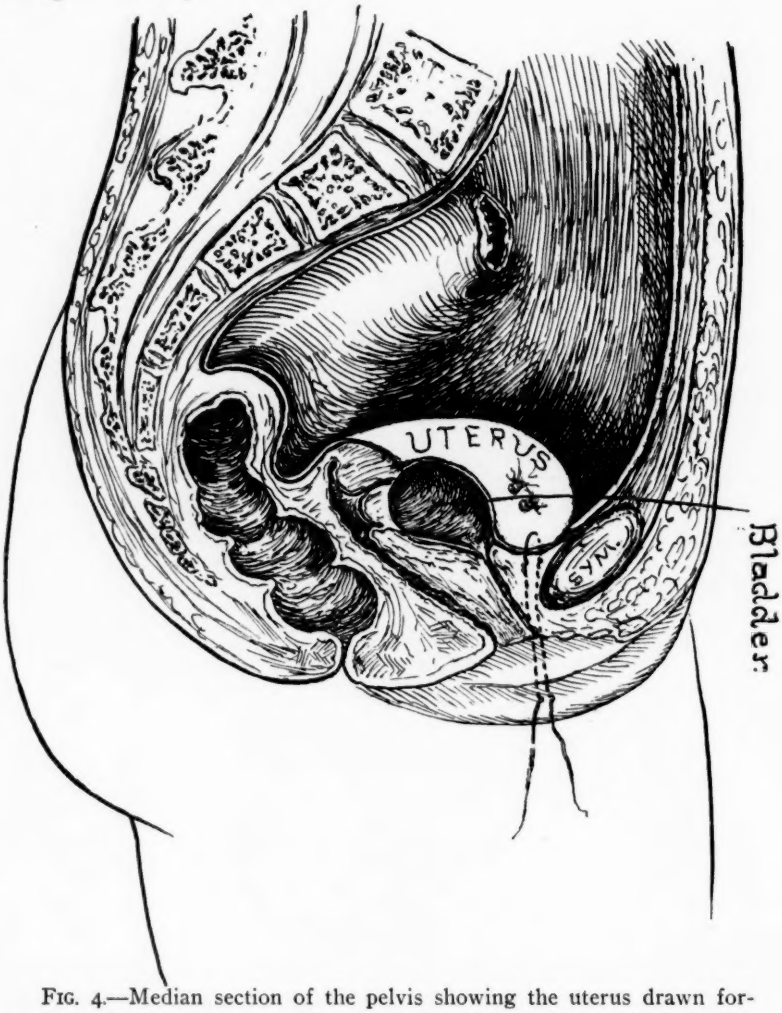


FIG. 4.—Median section of the pelvis showing the uterus drawn forward, the fundus acting as a plug to the hernial opening on the left side. The bladder is pushed towards the right side by the body of the uterus. The section shows a small portion of the bladder remaining on the left side. The cervix is represented as being cut by the median incision, while the body of the uterus is untouched.

The age of the patient and her repeated attacks of severe hæmorrhage seemed to justify the use of the uterus as a plug to

prevent the escape of the bladder through the hernial opening. For this purpose, the round ligaments, the Fallopian tubes, and ovaries were removed. The fundus of the uterus was then drawn down to the opening in the muscle and held there by a ligature, which was passed down through the pelvis and the tissues on the left side of the incision and tied on the outside. This procedure closed the opening and prevented the bladder from prolapsing. The body of the uterus had been freely scored with a scalpel before drawing it into this position. The abdominal wound was tightly closed. The redundant skin which had enveloped the tu-

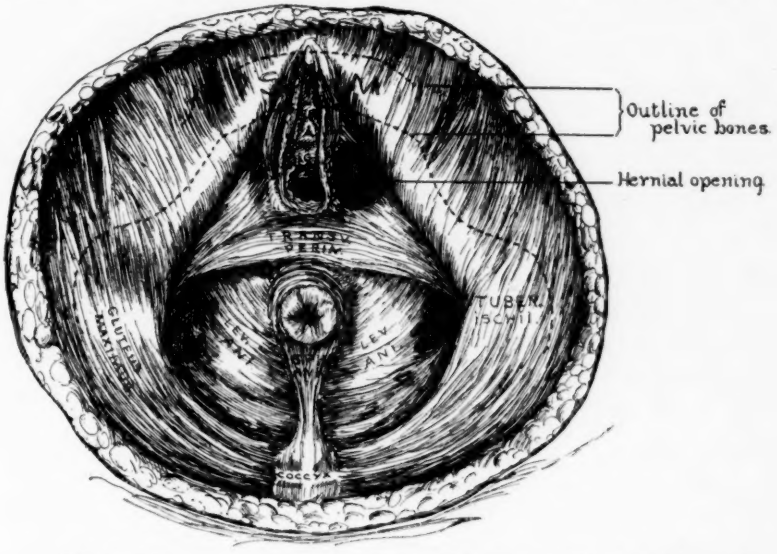


FIG. 5.—Shows the muscles of the pelvic floor. The hernial opening is indicated at the left of the vagina.

mors between the legs was removed. The incision from the pubes to the tuberosity of the ischium was closed except for a short distance at the lower portion, where gauze for drainage was inserted.

The patient made a good recovery. On the day following the operation, she was able to empty the bladder herself, and she has had no trouble with this function since.

After two weeks, the stitch which held the uterus was removed. The wound healed rapidly. Six months later the patient appeared in perfect health, and was able to do all her work as

cook. The body of the uterus was found at this time in the position in which it had been placed. Its displacement, antesinistroversion, gave no trouble of any kind.

Dr. William F. Whitney made the following report of the tumor which was removed. "A very moist, irregular, stringy growth of fibrous tissue, more or less connected together and blending with the subcutaneous tissue over a considerable area. Microscopic examination showed a mass of very finely felted connective-tissue fibrillæ, among which were occasional rather large mononucleated cells of connective-tissue type. Blood-vessels were present in moderate numbers and had definitely formed walls. Diagnosis, *Diffuse Œdematous Fibroma.*"

This fibroma seems to have had its origin in the subperitoneal tissue in front and to the left side of the bladder. In its growth it pushed through the fibres of the levator ani muscle and appeared in the left labium majus. Here it developed to the size of a fœtal head and was removed in 1893. In 1899 it had again developed to such size and was so attached to the bladder that by its weight it drew the bladder through the opening in the levator ani, producing a hernia and complete retention of urine. The hernia was paraperitoneal, as most hernias of the bladder are, that is, the hernial portion was only partly covered by peritoneum. Almost the entire bladder was included in the hernia, the portion remaining in the pelvis being drawn into a narrow tube by the traction of the tumor. The hernial portion held nearly one and one-half pints of urine without discomfort to the patient. The possibility of the cutting of some of the fibres of the levator ani muscle at the first operation in 1893 has occurred to the writer. This may or may not have happened. Before this operation, it was noticed that the tumor diminished markedly in size when the patient was lying down. No mention is made in the records at that time of any difficulty in micturition. It is probable that the bladder was then only slightly involved. The occurrence of severe abdominal pain, quickly followed by retention of urine in January, 1899, makes it probable that the complete hernia of the bladder occurred suddenly at that time. The fibrous

growth had no connection with the uterus. The opening in the levator ani muscle through which the bladder passed, extended from the pubic bone to the left of the symphysis backward in a line parallel with the vaginal wall. The bladder was pressed upward against the pubic arch by the resisting levator ani muscle below it.

Hernia of the urinary bladder is not common. A portion of the bladder may leave the pelvis by any of the openings through which intestinal hernia passes. Hernia of the bladder may be inguinal, femoral, or abdominal (in the linea alba), and through the floor of the pelvis it may be obturator, ischiatic, perineal, pudendal, or ischiorectal.

Brunner (*Deutsche Zeitschrift für Chirurgie,* 1898, Band xlvii, S. 121) collected 181 cases of hernia of the bladder of all varieties. Of these 128 were men and 44 were women, and of 9 the sex was not indicated. There were 138 cases of inguinal hernia, 29 of femoral hernia, 8 of perineal hernia, and 6 of other varieties. The average age of these patients was about fifty years.

Ebner ("Ueber Perinealhernien," Ludwig Ebner, *Deutsche Zeitschrift für Chirurgie,* Band xxvi, S. 48) studied the question of perineal hernia. He found by numerous dissections upon men and animals that clefts in the levator ani muscle often existed, and that these gaps were sometimes of considerable size. The peritoneal cavity between the rectum and the bladder (or between the rectum and uterus in women) is deeper in the embryo than in later life. If this embryonic cavity persists, it increases the possibility of perineal hernia. If both these conditions exist together, it makes the occurrence of a hernia through the pelvic outlet more probable. Ebner found records of intestinal hernias through the pelvic outlet in twenty-three cases.

Hernia of the bladder through the pelvic outlet is very rare. Ebner was able to find records of but ten cases; these records for the most part are very incomplete. Two of these hernias were in men in whom small swellings appeared in the perineum,—one to the right, the other to the left of the raphe.

In the cases among women a portion of the bladder usually appeared first in the posterior part of the labium majus. It sometimes filled the entire perineum. In one case a portion of the bladder was detected in each labium majus.

Allan Burns (*Edinburgh Medical and Surgical Journal,* 1808, Vol. iv, page 512) made a post-mortem dissection upon an old woman who had a pudendal tumor. The bladder was found to have protruded between the origins of the levator ani and the obturator internus muscles. Brunner found no reported case of hernia of the bladder through the pelvic outlet since 1860. Macready states that in the case of Burns (already referred to) a part of the bladder entered the right labium, and a part on the left side passed between the levator ani and the obturator internus to enter apparently the lesser sciatic notch.

The cases observed have none of them been operated upon. As a rule, the amount of swelling which appeared was slight, and this usually disappeared when the bladder was emptied.

Dysuria usually accompanied this form of hernia. Pressure over the tumor caused acceleration of the flow of urine.

In reference to subperitoneal tumors as a cause of hernia in the pelvic outlet, the case of Thomas (*Lancet,* 1897, Vol. ii, page 191) is of importance. In this case a hernia of the intestines in the ischiorectal space was produced by the dislocation of a subperitoneal fibroma. Thomas successfully removed the tumor and reduced the hernia by an operation from the outside.

The treatment of hernia through the pelvic outlet, whether of the intestines or of the bladder, must be governed by the conditions. The occurrence is so rare that conclusion of much value cannot be drawn from past experience. If the hernia is complicated by tumor, or if strangulation has occurred, operative treatment may be necessary. Age and debility of the patient may contraindicate operation unless the symptoms are urgent. With modern methods, it seems probable that intra-abdominal treatment would prove the most satisfactory in suitable cases.

ON THE INFLUENCE OF ANÆSTHESIA ON THE EFFECT PRODUCED ON THE CIRCULATION AND RESPIRATION BY IRRITATION OF A SENSORY NERVE.

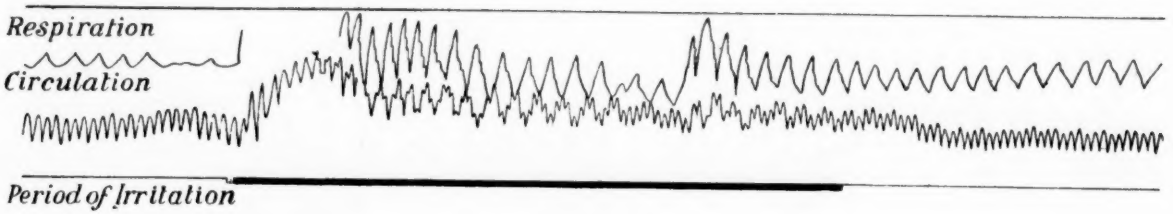
By SIMON PENDLETON KRAMER, M.D.,

OF CINCINNATI, OHIO.

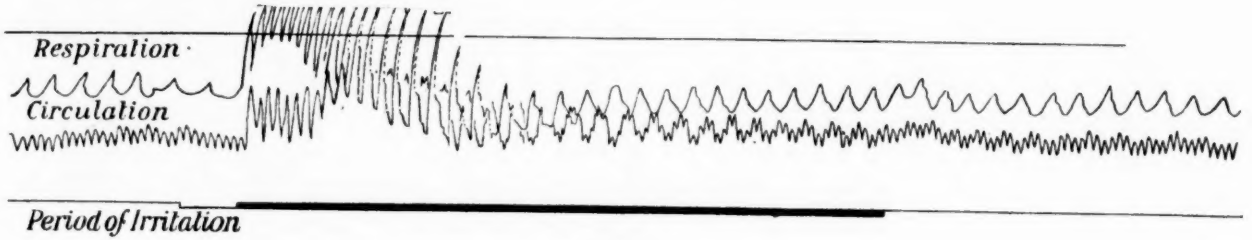
During the past three years the writer has been engaged in an investigation of the nature of shock. In the course of these experiments, certain phenomena concerning the influence of anæsthesia on the effect produced on the circulatory and respiratory apparatus by irritation of the sensory nerves have been observed that seemed worthy of some special notice.

The effect of irritation of sensory nerves on the circulation and the respiration is a matter upon which physiologists have held various opinions. Bezold ("Untersuchungen über die Inervation des Herzen's," page 272; Hermann's "Handbuch der Physiologie," Vol. iv, page 392) found that irritation of sensory nerves (sciatic, brachial, and spinal nerves, skin), after section of both vagi and sympathetic in curarized dogs and rabbits, produced an increase in the frequency of the pulse-rate and a rise in blood-pressure. This occurred only if the brain and cord were intact. If the medulla was severed, either from the brain or cord, this did not occur.

Lovén (*Berichte d. Saechs. Ges. d. Wiss.*, 1866, page 85) found that if the vagi were divided, irritation of sensory nerves produced either no change in the pulse-rate, or else the rate was diminished. Asp (*Idem.*, 1867, page 182) obtained after irritation of the central end of the divided ischiatic plexus or of the lumbar or dorsal cord, an increase in the frequency of the pulse both before and after section of the vagi. Hering and



TRACING I.

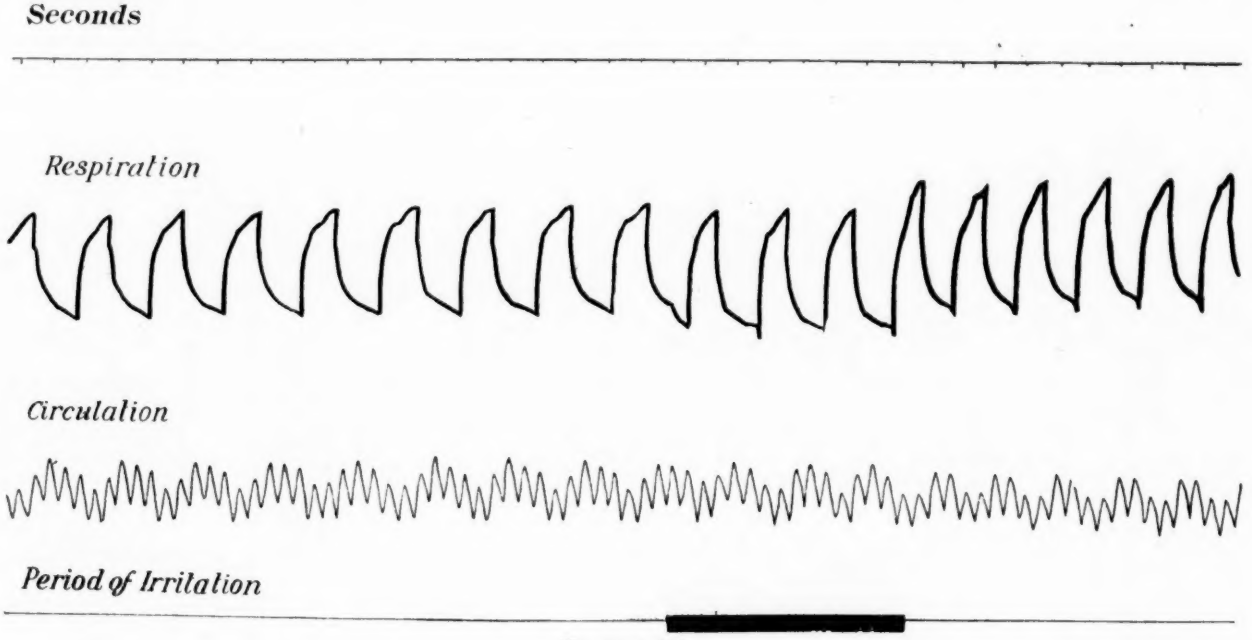


TRACING II.

Kratchmer (Sitzungs Bericht d. Wiener Acad., lxii, 2, page 147, 1870) irritated the nasal mucosa membrane with tobacco smoke and other gases, and stimulated the supramaxillary branch of the fifth; if the vagi were intact, a slowing of the heart with little or no rise in blood-pressure was produced. If the vagi were divided, no change in the pulse-rate followed. As a rule, it was found that irritation of a sensory nerve produced a rise in blood-pressure. Gad ("Physiol. d. Menschen," page 372) states that probably every painful irritation of a sensory nerve produces a dilatation of the vessels of the skin locally, and a contraction of the vessels generally, as is evidenced by a rise in blood-pressure. We shall see as the result of my own experiments that the element of pain is a very considerable factor in determining the effect of such irritation on the general blood-pressure.

Latchenberger and De Ahna (*Arch. für d. Ges. Physiol.*, xii, page 157, 1876) found that continued irritation of a sensory nerve did not bring on a continuous rise in blood-pressure. After a few minutes the pressure sinks until it gradually regains the pressure that existed before irritation of the nerve. If the irritation was kept up for many minutes or an hour with frequent interruptions, there was produced a sinking of the blood-pressure during the time of the irritation. This effect was produced sooner in animals that had had their cerebra removed.

R. Hunt (*Journal of Physiology*, xviii, 5 and 6, page 381) found that irritation of a sensory nerve produced sometimes an increase and sometimes a fall in blood-pressure. On the supposition that this difference in result might be due to the preponderance of pressor or depressor nerve fibres, his experiments were conducted in such a way as to eliminate one of these varieties of hypothetical fibres. He found that after section of a centripetal nerve the depressor fibres were regenerated earlier, so that central irritation of a recently regenerated nerve was always followed by a fall in blood-pressure. A similar result was obtained by refrigeration of the nerve; *i.e.*, the depressor fibres remained longest intact.



TRACING III.

The effect upon the respiration produced by irritation of a sensory nerve has been even more variously described by different experimenters. Schiff (*Moleshott Untersuch.,* viii, page 313) found that mild irritation of sensory nerves produced a slowing of respiration, and at times even a temporary cessation in expiration. Rosenthal (Herrmann's "Handbuch d. Physiologie," Vol. iv, Part II, page 252), with electrical stimulation of the crural nerve in unnarcotized animals, observed violent inspiration and expiration; in narcotized animals, no appreciable effect.

Langendorff (V. Wittich's Mittheil. ad. Königsberger Physiol. Lab., 1878, page 33) found that mild stimulation of a sensory nerve had an inspiratory effect, stronger stimuli, an expiratory.

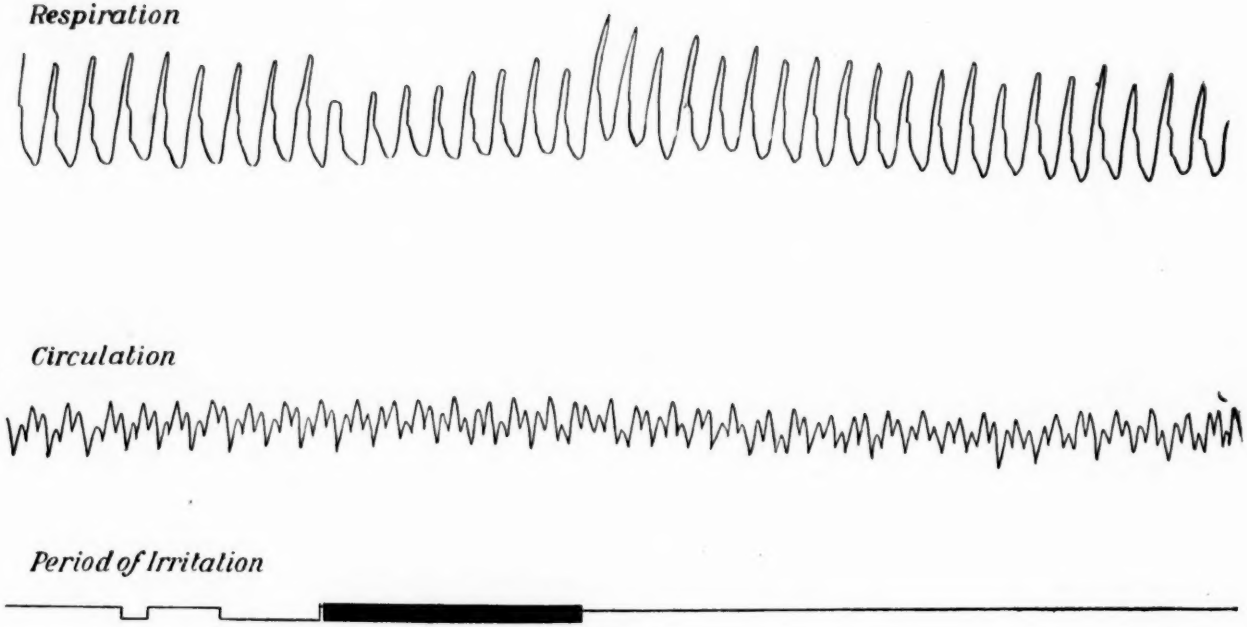
In deeply narcotized animals, and in animals in whom the cerebrum had been removed, he often observed an increase in the rhythm, oftener a mild inspiratory tetanus; if the irritation were kept up a longer time, or if it were increased, a slowing of the rhythm followed. It is very probable that the variation in the effect observed is largely due to the varying state of narcosis present. The effect of irritation of a sensory nerve in all probability passes through the cerebrum, and the condition of the cells of the cortex would have a great modifying influence on the effect that would follow on the respiration and circulation.

Method of Investigation.

Anæsthesia.—The animals used were dogs, and when anæsthesia was used, ether was invariably employed. During the experiment, the ether was administered through the tracheal tube.

Record of Circulation.—The blood-pressure and cardiac contractions were recorded by means of a mercurial manometer connected with the right carotid artery.

Record of Respiration.—The movements of the thorax were recorded by means of a Paul Bert exploring tambour attached to a strap of adhesive plaster which encircled the lower



TRACING IV.

portion of the chest. This tambour was connected by means of a rubber tube with a Marey tambour, whose writing lever thus recorded the movements of expansion and contraction of the chest. The up stroke represents the inspiratory movement; the down stroke, the expiratory.

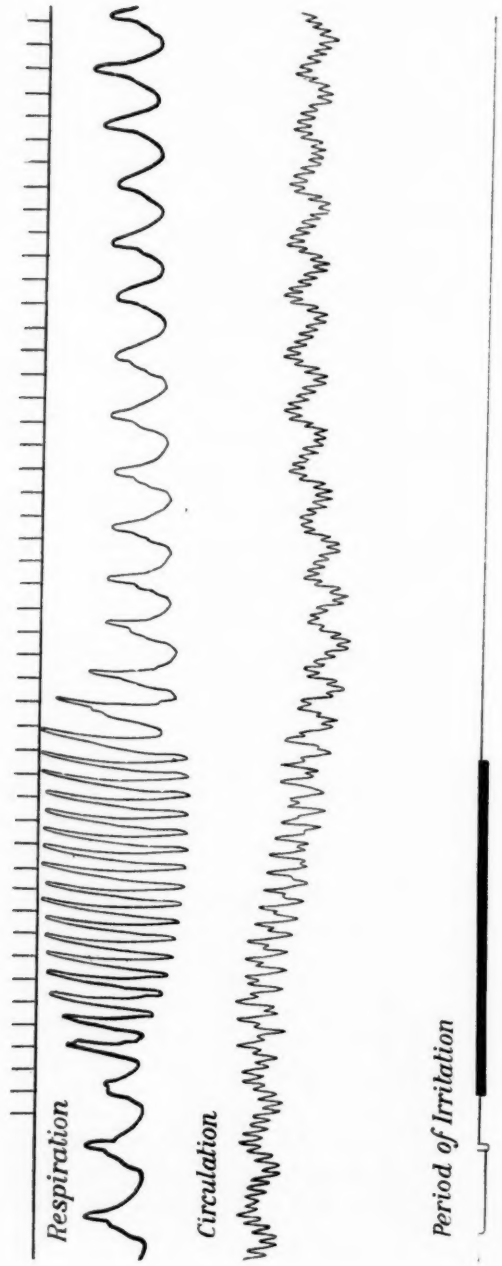
Record of Time.—The time was recorded by means of a metronome beating seconds, placed in circuit with an electric signal, thus transmitting its rhythm to the signal, which marked the time on the paper of the kymograph.

Record of the Time of Stimulation of the Nerve.—In all experiments, the right crural nerve was divided and the central end stimulated electrically. For this purpose a Du Bois Reymond apparatus with platinum electrodes was used. The separation of the primary and secondary coils is given in each case. An electric signal was placed in the primary circuit of the apparatus, so that the time during which the nerve was irritated was marked on the paper of the kymograph. In all, twenty dogs were used. Many experiments were made on the same animals in various stages of anæsthesia. In only one dog was no anæsthetic employed. The results here were constant and have been described before, so that I did not deem it justifiable to repeat this experiment.

Phenomena observed in Unnarcotized Animals.—Stimulation of the central end of the crural nerve in an animal that had received no narcotic always produced the same effect. The respiration was increased in frequency about 50 per cent., and the inspiratory effort was markedly increased.

The cardiac rhythm was also increased approximately to the same extent. The blood-pressure invariably rose. These effects gradually disappeared after the cessation of the stimulation, so that about one minute thereafter the respiratory rhythm and force were as before, and the same was true of the circulatory apparatus.

Tracing I was obtained from a typical experiment of this kind. The coils of the faradic apparatus were ten centimetres apart. The stimulation occupied a period of forty-three seconds. The respiration was markedly increased in force and in



TRACING V.

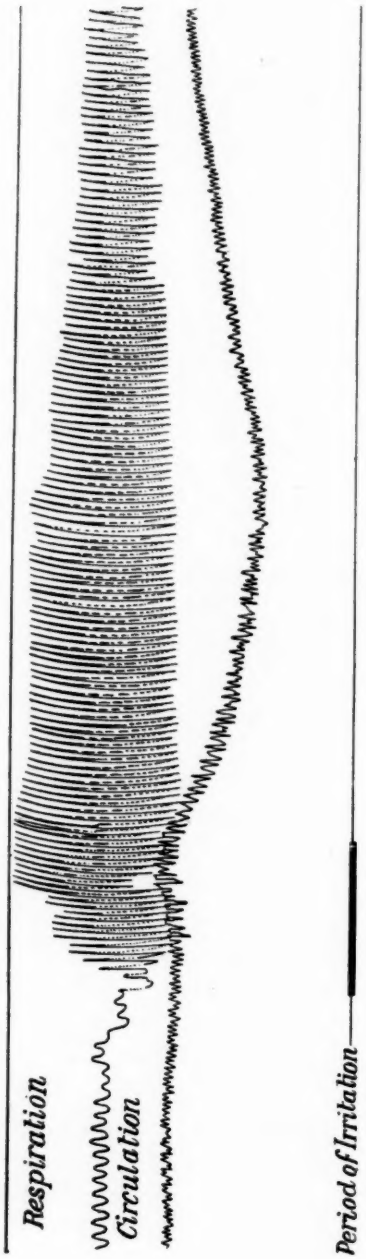
rhythm—from 32 per minute to 48 per minute; the cardiac contraction from 92 per minute to 104 per minute. The greatest rise in blood-pressure was 44 millimetres.

Tracing II is from a similar experiment in which the effect on the respiration is even more marked. It will be seen in these tracings that the effect is greatest at the beginning of the irritation. When this is kept up for some time the effect wears off, so that after thirty or forty seconds it is scarcely appreciable. This corresponds with the observation of Latchenberger and de Ahna.

Effect on Narcotized Animals.—If the animals were deeply anæsthetized with ether so that there was absolutely no corneal reflex, the result was very different. In most instances the irritation of the central end of the crural was without effect either upon the circulation or respiration.

Tracing III shows such an experiment. The nerve was stimulated with the faradic coils ten cubic centimetres apart, and the circulatory and respiratory curves are unchanged. At other times there is a very slight effect on the respiration in that the inspiration is slightly inhibited. The rhythm remains unchanged and the circulation is not disturbed. This is very well shown in *Tracing IV*. From this it may be seen that the effect of irritation of the sensory nerve depends in a very great measure on the condition of the sensorium. If this is completely paralyzed, we have practically no effect; if it is unnarcotized, we have the effect seen in the first series of experiments.

On the other hand there is a condition of the sensorium between these two which very materially alters the effect. If the animal is anæsthetized, but only partially, so that there is a condition of semianæsthesia in which the corneal reflex is present, but in which the animal lies quietly on the table, then we have a very different effect. In such animals the respiration, just as in the unnarcotized animals, becomes greatly accelerated in rhythm and increased in amplitude. On the part of the circulatory apparatus, a very different result is observed. Instead of an increase in the pulse-rate and a rise in pressure



TRACING VI.

as occurred in unnarcotized animals, we have a marked fall in blood-pressure. This fall begins a few seconds after the beginning of the irritation of the nerve, lasts for a varying number of seconds, and eventually returns to the level present before the irritation. It may be preceded by a slight rise, probably due to the increase in the force of the cardiac contractions.

Tracing V shows such an experiment. The corneal reflex was present, and the coils of the faradic apparatus were ten centimetres apart and the nerve was irritated for fourteen seconds.

In *Tracing VI* this " vasomotor shock," for so it may be termed, is much more marked.

The stimulus was much stronger here, the coils being five centimetres apart.

In every experiment there was a stage of narcotization at which the irritation of the central end of the crural nerve produced this fall in blood-pressure.

The conclusion may be drawn from these experiments that severe vasomotor shock is more liable to follow operations done under partial anæsthesia than such as are done under complete insensibility.

THE PATHOLOGY OF FRACTURE OF THE LOWER EXTREMITY OF THE RADIUS.

By FREDERIC J. COTTON, M.D.,

OF BOSTON, MASS.

(Concluded from page 218.)

VII. *Fractures of the Radial Styloid* occur, and may be either in the form of an oblique fracture downward into the joint, or of a simple breaking away of the styloid process as such, or of a part of it, in which case the fracture line may be nearly transverse.

Specimens of the first class are reported and described by Callender, St. Thomas Hospital Museum, B16; School of Physic, Trinity College Museum, 291, described by Bennett, plate by Roberts; Hunt (see Fig. 20).

Instances of the breaking off of the process alone are less uncommon. Bennett (united specimen); Guerin, autopsy (cited by Schmit); Warren Museum, No. 4631 (Fig. 19); Packard, specimen in Wistar-Horner Museum; Callender, London Hospital Museum, no number; Middlesex Hospital Museum, I, 23c; Letenneur, autopsy; Power, King's College Hospital Museum, No. 643.

Helferich gives a plate of a case—original observation—where the tip of the styloid alone is separated; this, however, is exceptional, was evidently the result of traction, and is not fairly to be classed as a feature of Colles's fracture.

The fractures of the radial styloid may differ little from the more usual forms as seen clinically, but there seems a tendency in these cases to displacement outward rather than backward. This may be extreme, as in a couple of cases mentioned by Hamilton, in which the apparent lesion was an ob-

lique splitting off of the styloid with extreme displacement upward and outward. He thought this displacement due to

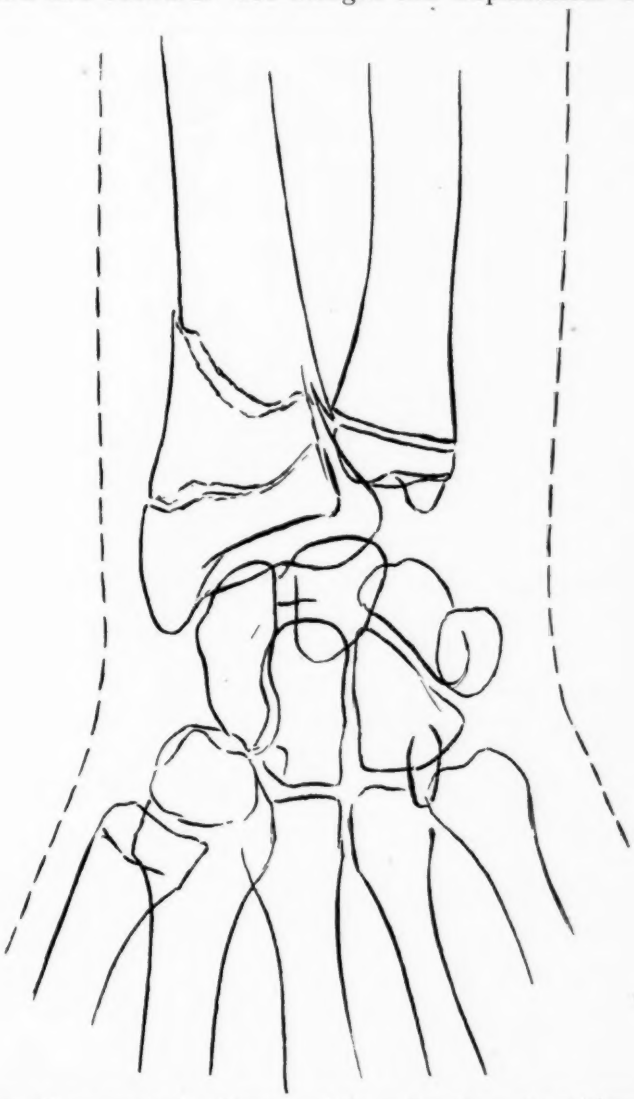


FIG. 16 (X-ray tracing).—Fracture of the radius above the epiphyseal line oblique upward and outward—after reduction; epiphyses of radius and ulna ununited.

the action of the supinator longus; but it seems quite as likely that this position is simply retained by the muscles after the

force splitting off the fragment has carried it upward. At all events, the pull of the supinator longus on a small fragment does not necessarily cause such displacement; in the specimen reported by Bennett some actual displacement inward is evident.

As will be noted later, there seems to be an essential difference in mechanism between this group of fractures and those of the last group as contrasted with the more usual forms of Groups I and II, and III and V.

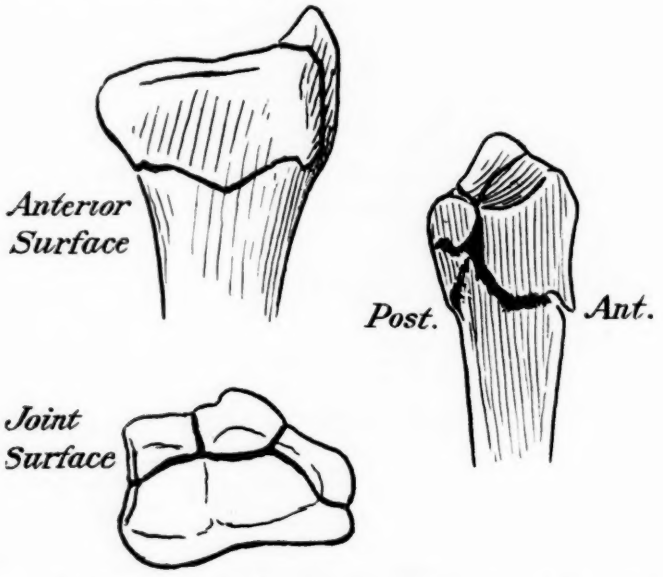


FIG. 17.—Fracture showing lines of comminution into joint; plane of fracture nearly transverse; backward displacement; some crushing and loss of substance at the back (after McGraw and Walker).

VIII. *Fractures Oblique Downward and Outward.*—These are very unusual, whether as a fracture running obliquely through the whole bone, or as a splitting away of a fragment at the ulnar side alone. Of the first sort, Bennett describes a specimen in the Museum of the School of Physic in Trinity College, No. 695, of which Roberts gives an excellent plate, showing an obliquity of about thirty degrees downward and outward; Gordon gives a plate (his Fig. 6) of

a like specimen; there is no great displacement or rotation in any direction. Hennequin cites a case by Poirier where the obliquity in this direction was obvious clinically, and Haughton (his Case I) shows in a skiagraph a like lesion; so, too, Picard (his Observ. II). Smith describes a specimen (his Case XI) in which there was slight obliquity of the line of fracture in this direction. Specimen 3776 of the Warren



FIG. 18.—Combination of transverse and oblique fracture lines; antero-posterior split into joint; fracture of shaft of ulna. Anterior view (after Westbrook's plate).

Museum shows a splitting away at the ulnar side as well as at the back (see Fig. 10), oblique in this direction.

Splitting away of the ulnar portion of the radius alone is also noted by Packard in the specimen numbered 128 in the New York Hospital Museum. Hall reports a clinical case, pretty clearly of this form. Bardenhauer speaks of a specimen showing a small portion separated, apparently torn away from the radius by the radio-ulnar ligaments.

A small fragment may be split away from the ulnar side



FIG. 19.—Fracture of radial styloid; separation of ulnar styloid at its base; from direct violence. Warren Museum, No. 4631.

of the lower fragment in a transverse fracture, as in the specimen in the Warren Museum, No. 1038. (Fig. 9.)

Kahleyss notes a like case shown by the X-ray (his Tafel VI, No. 9).

IX. *Cracks and Splits of the Radius not Penetrating the Width of the Bone.*—These may be apparently in any direction; but the recorded cases and specimens show either longitudinal splits or cracks running nearly transversely.

The first class is best known through the much-quoted specimen presented to Warren Museum by Dr. Bigelow (No.

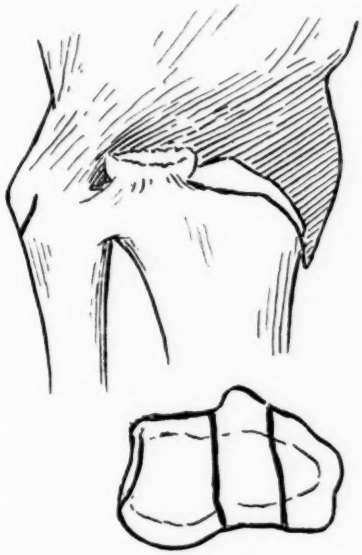


FIG. 20.—Comminuted fracture running obliquely down and inward into the joint; fracture of the semilunar bone; partial fracture of ulnar styloid (after Hunt's plate). Anterior view and view of lower end.

1035, shown in Fig. 21), described by him in the *Boston Medical and Surgical Journal,* Vol. lviii, p. 99. In this specimen there is no transverse fracture, though one relatively small fragment is chipped or rather slivered off. Pilcher figures a similar specimen from the New York Hospital Museum (his Fig. 20).

Bennett figures a specimen in the Museum of the Royal Academy of Ireland showing similar cracks.[1] In this case

[1] British Medical Journal, 1892, i, 903.

the clinical history is recorded; the fracture was caused by the wrist being caught in machinery; and it seems very likely, according to Bennett's experiments, that direct violence is the cause of this particular lesion. Crushing with a boot-heel gives such lesions on the cadaver, and there is no evidence to support Bigelow's theory of the wedge-action of the carpal bones as the cause.



FIG. 21.—Dr. Bigelow's specimen of fissure of the radius. Warren Museum, No. 1035.

The transverse fissures, on the other hand, would seem to be a result of the same violence that produces the ordinary transverse fracture, acting in less degree.

The writer has lately met with five cases of this type (skiagraphs of two of these are given in Figs. 22 and 23). In these cases the cause seems to have been a fall on the palm,



FIG. 22 (Tracing from X-ray negative).—Fissure across inner portion of the radius only; fracture of the ulnar styloid process.

save for one where there was clearly a fall on the ulnar side of the hand. In all five there was sharply defined tenderness at the position of the crack; in no case was there any dis-

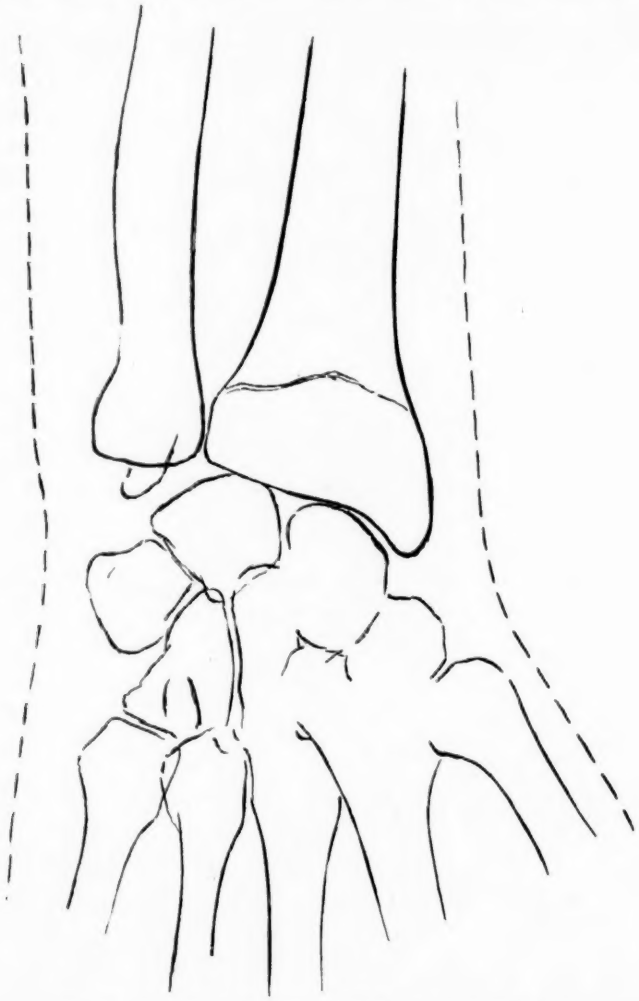


FIG. 23 (X-ray tracing).—Fissure of radius (or possibly transverse fracture without displacement).

placement; in one case there was associated fracture of the ulnar styloid.

As to other recorded cases Packard recognized the possi-

bility of transverse fissure in 1879, while Kahleyss quotes Bruns as recognizing their occurrence, and gives skiagraphs, or rather diagrams from skiagraphs, of two cases of his own belonging to the latter class—the transverse.

There seem to be no data for estimating the actual frequency of longitudinal fissures; they are apparently rare. The transverse cracks are distinctly less unusual; and it would seem that it should be possible to make the diagnosis provisionally by direct examination from the sharply localized tenderness—definitely by means of the X-ray. The writer is inclined to think that careful routine examination of sprains of the wrist from falls on the hand may show a fair proportion of such lesions.

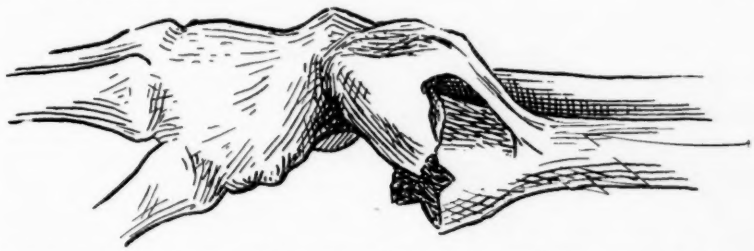


FIG. 24.—Fracture with backward displacement and backward rotation. Shows the stripping up of the untorn periosteum posteriorly (after Westbrook's plate).

There may be other lesions of the radius than those already described, occurring either as an accompaniment of the type fracture or as an independent result of apparently similar trauma. Bennett and Moore each describe autopsy cases where a fracture of the radial shaft higher up accompanied a Colles's fracture. See also a specimen by Dupuytren, quoted by Packard, and the specimen in Warren Museum, No. 1038. Also an autopsy by Cock showed the same lesion, and one by Di Paoli, a greenstick fracture at the middle of the radius with separation of the lower radial epiphysis. The fracture of the radius at the middle third occurring from falls on the hand, apparently in a sense as an equivalent of Colles's fracture, is not extremely rare. Falkson, for example, gives three such cases.

To complete the list of lesions of the radius, Bennett reports a case of *necrosis* of the lower radial fragment in Colles's from unknown cause, and Packard a necrosis of the radial styloid alone, not involving the whole epiphysis. Necrosis in compound suppurative cases has been frequently reported. Abscess from simple fracture has occurred as well as from simple epiphyseal separation.

Lesions of the Carpal Bones seem, in the light of skiagraphs, to be less rare clinically than most clinicians had supposed. Actual anatomical demonstrations of these fractures as accompaniments of Colles's fracture have not been lacking.

Hunt's autopsy report gives a description and plate of a fracture of the semilunar, accompanying an oblique fracture of the radius into the joint. (Fig. 20.)

Kahleyss gives a case of semilunar fracture with Colles's, —a skiagraph. Weir has produced the same thing experimentally.

Fractures of the os magnum with radial fracture have been described, according to Kahleyss, by Bardenhauer. Wight saw at autopsy in one case a piece broken out of the cuneiform. Destot and Gallois produced such fractures experimentally.

The relatively frequent carpal fracture in relation to Colles's is, however, that of the *scaphoid,* a number of cases of which have been described lately, while a considerable number of anatomical specimens are on record: Rutherford, autopsy; D'Arcy Power, St. Bartholomew Hospital Museum, No. 924; Fortunet (recent specimen, quoted by Hoffa), and Flower, Middlesex Hospital Museum, I, 23c, record such cases verified by autopsy. Flower also records a specimen where there was a Colles's fracture and a partial fracture of the scaphoid.

Interesting in this connection is a case cited by Cameron of total dislocation forward of the scaphoid with typical Colles's fracture. An interesting case (reported by Letenneur, quoted by Stimson) was that of a patient who fell, striking both hands and fractured the radius on one side, the scaphoid on the other.

This suggests that the scaphoid fracture may be in some

sense equivalent to the radial fracture, at least a result of like forces. The writer has recently had under his care a case of fractured scaphoid where there was no radial fracture, and yet the history was of a fall on the palm. Such cases seem not very rare. King reports a scaphoid dislocation without fracture, likewise from a fall on the palm.[1]

Kahleyss has called attention to the association of scaphoid fracture with fractures of the radial styloid, and points out that in two of the three cases included in his skiagraphic series the line of fracture across the neck of the scaphoid is nearly continuous with the line of fracture of the radius, and in Hunt's case of semilunar fracture the same continuation of the line of fracture is obvious. (See Fig. 20.)

It may be that the fracture of the scaphoid is a result of forced abduction, or, as Destot and Gallois conclude from their studies, of the reception of the impact of the fall by the scaphoid, which, as they point out, is vertical to the ground when weight is borne on the palm.

Lesions of the Ulna, of the Bone itself.—The most common is the fracture of the styloid process, but other fractures do occur.

(1) Fracture of the shaft. Such a fracture may occur at any point, more usually well above the radial fracture, most often about two inches above the wrist. It is a question in some cases whether such fractures may properly be classed as Colles's, but they seem in many cases to be the resultant of similar forces, and, as far as the radial fracture goes, show no distinctive features.

The cases of Westbrook (Fig. 18); Moore (2); Butler; Callender (2); Bruns; Kahleyss (four skiagraphs); D'Arcy Power, London Hospital Museum (Gbi-6), all cite such specimens or X-rays; while this fracture as a complication of separation of the radial epiphysis is instanced by the dissected cases of Roux, Di Paoli (four cases), Hilton, Boeckel, Hartmann, Smith, Bennett, Labadie-Legrange, and a specimen in St. Bartholomew Hospital Museum. In all these specimens

[1] ANNALS OF SURGERY, Vol. xxx, 1899, p. 213.

the ulnar fracture seems to be low down, often very near the epiphysis. A like case is shown in Fig. 25.

In this connection may be mentioned a type of fracture occurring in small children, where both bones give way above the epiphyseal lines in a greenstick or a complete fracture, with displacement backward, or without any considerable displacement. The writer has recently had an opportunity to examine two such cases, and has seen besides these several skiagraphs of similar lesions,—of fractures approximately transverse of the radius and ulna at about the same height, well clear of the epiphyseal lines. These fractures are apparently due (though the point is hard to determine in young children) to falls on the palm, such as give fracture of the radius alone in adults, or such as may give epiphyseal separations in the child. Wight in one case (a boy of eight) found this type of fracture where the dirt ground into the palm attested the way the fall was received.

Warren Museum specimens 1029 and 1030 are casts of this form of fracture, and 1039 shows sequestra from a like fracture.

Freeman gives a good skiagraph of such a case.

Damage to the head of the ulna is apparently a rare complication, but von Lesser assumed it to be a relatively usual lesion, accounting for limitation of pro- and supination, and with this idea in mind he convinced himself that the lesion was relatively frequent in the specimens preserved in the Pathological Institute at Leipzig. Actual demonstrations of such lesions are, however, rare.

Bennett reports an autopsy which showed with the radial fracture a vertical splitting of the head of the ulna, and cites a specimen in the Hunterian Museum in London as showing like lesions.

Kahleyss showed in the skiagraph a fracture of the ulnar head, and Corson publishes a plate (Case IV) apparently showing a like condition. Helferich figures a specimen with partial fracture across the head of the ulna, with separation of the radial styloid as well, the result of traction; and Hoffa



FIG. 25.—Fracture of the radius; fracture of ulna near the joint; much crushing of bone in the radius; marked outward and upward displacement and rotation; fragments freely movable; delayed union.

is responsible for the statement that a splitting away of a small portion of the head on the volar surface is not infrequent. The writer has found no specimens or record of specimens to substantiate this.

A separation of the ulnar epiphysis is rare as a complication either of the simple separation of the radial epiphysis or of the fracture. Poland lists nine such cases. Of especial interest in this class are one with a partial separation, only, of the ulnar epiphysis (Voillemier, cited by Poland), the other, a separation of the ulnar epiphysis with a vertical fracture splitting it, a case of Di Paoli, of which Poland gives an excellent plate.[1]

Fracture of the ulnar styloid, now acknowledged to be a frequent complication, has in the past been a much disputed lesion. Nélaton, Velpeau, Tillmanns, Moore, Hoffa, Bennett, and Lucas long since asserted its frequency, but surgeons of equal authority failed to recognize the fact, and insisted on the infrequency of this complication.

The skiagraph, however, has definitely demonstrated that the lesion is a very common one. Kahleyss in a series of sixty cases of Colles's found this fracture in forty-seven, and a number of short series (*e.g.*, those of Thomas, Freeman, Don, Corson, Haughton) show even higher percentages. In forty-five skiagraphs of unpublished cases which the writer has had the opportunity to examine the fracture is definitely shown in eighteen. Beck in a series of forty-four cases found the fracture in but seven. Evidently, the percentage, as well as the interpretation of the pictures, is subject to much variation. Lucas found the styloid gone in fifteen of twenty-eight specimens he examined.

Of five specimens in the Warren Museum four show this lesion. Bennett calls attention to the fact that the proportion of broken styloids is larger than old museum specimens indicate, for they are often much damaged in maceration.

[1] The specimens, St. Bartholomew Hospital Museum, 931, 932, are described as showing a like lesion, with radial fracture one and a quarter inches up.

Moore in seven cases (autopsies and operations) found fractured styloids in five; Cameron in all of a similar series of five; Bennett in two out of three fresh specimens; Lucas in two cases out of three.

The break may be across the base of the process (Figs. 19, 20), at the middle of its length (Figs. 12, 22), or even of the tip only. Kahleyss divides his forty-seven into fracture of the base, 24; of the tip, 13; incomplete fractures in 10.

Fractures of the process appearing incomplete in the radiograph are by no means infrequent (see Fig. 4); and Moore records a case (separation of the radial epiphysis) where such an incomplete styloid fracture was found at autopsy; Hunt reports the same lesion in Colles's fracture of an adult. (Fig. 20.) In these incomplete fractures the beginning separation seems to be invariably on the inner (ulnar) side.

Skiagraphs rarely show two instead of one distal fragment. This seemingly occurs only in fractures of the tips.

There may be no displacement of the fragment, but, as a rule, it is dragged outward,—often far out of its position: there may be a considerable rotation of the fragment as well as displacement. When the fracture is incomplete the deviation seems to be always outward. One skiagraph is recorded with displacement up and in, and the writer has seen another plate showing displacement directly inward. The fracture of the ulnar styloid does not seem to be associated especially with any of the varieties of the radial fracture. The writer has seen it accompanying transverse fractures without any displacement;[1] and it may be absent in fractures with much comminution and in fractures with considerable outward displacement of the radial fragment, a condition which would naturally be expected to imply a constant giving way of either the styloid or the lateral ligament. (See Fig. 15.)

The lesion may occur with anterior displacement, as is

[1] In Fig. 22 is shown a complete styloid fracture where the radial fracture is represented only by a transverse crack only partly traversing the bone.

evidenced by a specimen cited by Callender (in the Westminster Hospital Museum). Clinically, the lesion is in itself unimportant, and at least hard to recognize without the aid of the X-ray.

Jones claims to have found it by manipulation in five of 105 cases, Golebiewski in three out of forty-five. The writer has never felt able to base more than a suspicion of this lesion on the evidence of simple manual examination.

The importance of the lesion lies in the fact, shown by Moore, that the sharp proximal end may become entangled in the ligaments in such a way as to interfere with reduction. This styloid chisel may also determine the protrusion of the ulna through the skin. Such compound fractures are not very rare. It is possible, also, that the damage to the styloid may explain certain cases of persistent pain about the ulnar head after Colles's; this is, however, by no means certain.

The broken process unites by fibrous union. In the only unmacerated specimen the writer has had an opportunity to examine [1] there was firm fibrous union by a band long enough to permit free play of the distal fragment. Lucas records a case with a separation of two lines. Cameron speaks of a similar specimen with a broken tip of the ulnar styloid, separated from the proximal fragment by a "tiny synovial-like cavity." Roberts refers to a specimen (Mutter Museum, 1277, 60) as "now united to the head of the bone," but does not definitely state that union was bony: all other recorded examinations speak of fibrous union. In the specimen 4631 of the Warren Museum there was recorded, before maceration, firm fibrous union of the styloid.

Lesions of Ligaments—The Internal Lateral Ligament.—The fasciculus of this ligament attached to the ulnar styloid may be torn away, as in specimens recorded by Gerard-Marchant, Moore, and Bennett.

Aside from this is the tearing described by Moore, due

[1] A dissecting-room specimen of united Colles's fracture, examined by courtesy of Dr. Thomas Dwight.

to penetration by the broken ulnar styloid and resulting in an entangling of the broken process with the ligament.

The triangular fibrocartilage may be variously torn. It may be torn loose from its insertion at the base of the ulnar styloid. Moore gives three such cases, Lucas two, Bulteau one case of entire, one of partial separation of this attachment: or the radial attachment may be damaged, as in a second case by Bulteau, another by Callender, St. Bartholomew, III, 89, and two by Lucas; or the cartilage itself may be torn across: Cameron (2); Moore (2); D'Arcy Power (King's College Hospital Museum, 643).

The other radio-ulnar ligaments may be entirely or partly torn away. This lesion seems, in view of the widening of the wrist seen clinically, to be a rather common lesion,—for this widening is too constant to be explained by comminution of the radial fragment, and often too considerable to be explained by inflammatory thickening or rotation of the fragment. According to statistics of the Boston City Hospital,[1] it occurred in thirty-six of thirty-nine cases, measured after union had taken place, and varied from one-eighth to three-eighths of an inch, and in ten of thirty-six amounted to one-quarter inch or more. Moreover, though the X-ray can give no direct evidence as to the condition of the ligaments, yet it is notable that many cases show a decided change of relation in the bones,—a distinct gaping between radius and ulna that is impossible of explanation without assuming a giving way of the interosseous connections. In that other class of cases where there is extreme upward displacement of the whole lower fragment, these ligaments must of necessity be destroyed.

Strangely enough, the actual lesion is not mentioned in most of the autopsy reports. Bulteau, however, notes as follows in one of the cases he autopsied:

" La tête cubitale a également perdu ses attachés avec la partie interne du radius, et n'est plus maintenue au corps que par quelques faisceaux ligamenteux qui semblent faire partie du ligament antérieur de l'articulation."

[1] Boston City Hospital Reports, Series VII, 1896.

Cameron also notes the tearing away of this connection in two fresh specimens examined by him. The X-ray appearance is well shown in the plate of Case II in Don's article. It is unfortunate that data on this point are not fuller, for the broadening of the wrist, apparently due to this lesion, is clinically, if of more than very moderate grade, often associated with a poor functional result after union of the fracture. In one case of the writer's there was a persistently recurring snap forward of the ulna in supination, apparently due to a loss of the interosseous connections.

Bardenhauer has recorded a case in which he found a fracture as an equivalent of this tearing—a small sliver of the ulnar surface of the radius ripped away—corresponding to the lesion sometimes occurring in Pott's fracture of the ankle.

Periosteum.—The periosteum, torn anteriorly in all cases with any amount of displacement, may be simply stripped up behind, and that for a considerable distance. This is well seen in Fig. 24, and is not confined at all to epiphyseal separations, though common in them. Pilcher has called attention to this relation of the periosteum as a factor increasing the difficulty of replacing the lower fragment.

The relation of the periosteum to the fragments in comminuted Colles's fractures is interesting. It may of course be variously torn; but in a considerable portion of cases the splits that separate the fragments do not involve the periosteum, and the lower fragment is, as a whole, pretty closely held together. This is noted in several autopsy reports already cited, and is verified in producing experimental fractures on the cadaver.

Injuries to nerves are rarely demonstrated. Lucas gives a plate showing the stretching of the ulnar nerve over the head of the ulna, which he blames for the persistence of pain in this region; as a matter of fact, the ulnar nerve seems practically never damaged. Cameron speaks of a case where there was a fractured styloid and torn triangular ligament, where there was actual pinching of the ulnar nerve. The case reported by him of pressure on the median nerve was really due

to the dislocation forward of the scaphoid which accompanied the radial fracture. Brunner gives an account of alleged pressure from the radial callus, giving rise to a so-called "tetanus," which subsided on freeing the nerve from callus. The only case of nerve involvement seen by the writer was one of general atrophy of the whole forearm with change in the electrical reactions,—of unexplained causation not to be directly connected with the typical Colles's fracture, though doubtless due to the accident. After an interval of four months power had returned to the arm and hand, save for a weakness of the thumb in flexion, which persisted for some weeks longer and then disappeared.

Lesions of Vessels.—Injury to vessels of any size seems to be exceptional. One specimen in the Warren Museum (No. 8117), obtained from an amputation for gangrene, where gangrene resulted from a tear of the radial artery by a spur of the upper fragment, seems to be unique.

Hæmorrhage from smaller vessels is common, rarely extensive, and may occur in various situations. The Couper-Hutchinson autopsy disclosed hæmorrhage between the tendon-sheaths, and two cases with hæmorrhage beneath the flexor tendon-sheaths and bleeding into the tendon-sheaths are reported by Cloquet and Bruns; both these cases were epiphyseal separations.

Lesions of the soft parts other than those already mentioned are rare. In a few cases only has *compound fracture* occurred. Lucas reports an autopsy in one such case, as does Bennett. Callender speaks of a compound Colles's fracture followed by gangrene, and Hecht's case was also compound.

Compound separations of the radial epiphysis are considered under that head; for some reason they are far less rare than is the case with the true fracture.

Penetration of the skin by the end of the ulna is not very uncommon, comparatively. Moore describes two such cases, Gaugeot three (quoted by Schmit), Cameron two, and Gerard-Marchant one. Lucas's case cited above showed penetration

of the skin by the radius and ulna through different wounds on the wrist.

Abrasions on superficial wounds opposite the luxated ulnar head on the volar side are of course fairly common.

Gangrene seems (save for the case with torn radial artery above mentioned) always to have been a result of tight bandaging or of sepsis from wound infection.

Suppuration occurs substantially only through wound infection, though Hutchinson does give a case of simple epiphyseal separation where abscess and necrosis occurred.

As to the secondary lesions of the fracture, there are almost no exact data. Certainly, stiffening of the fingers follows in certain cases, especially if they are not early mobilized, and this has been assumed a result of adhesions in the tendon-sheaths and compression by callus, but there seem to be no specimens to show this. Stiffening of the wrist is usually temporary, except as due to arthritis or bony deformity.

Various grades of secondary arthritis must exist, as evidenced by increased bony deposits about, and even in, the joints in museum specimens (see Fig. 3), and fresh distorted eburnated surfaces appear where the displaced radius meets the ulna, above the normal articulation; but what the processes in the joint are to which these appearances in the dry specimen correspond, what the clinical appearances are to which they correspond, there seem to be neither specimens nor examinations to show.

Such, then, are the lesions, the occurrence of which, as variations in the essential lesion, or as complications of the fracture, is attested by definite anatomical evidence.

As to the frequency with which these individual lesions occur, it is yet early to speak confidently. On this point the anatomical data are of secondary value, and reliance must be placed on the skiagraph and on the evidence of ordinary clinical examination. The only published series of skiagraphs of any considerable importance are those of Kahleyss and of Beck, covering sixty and forty-four cases respectively. Other series are of relatively small numbers. The writer has had oppor-

tunity to examine carefully some fifty or more unpublished X-ray negatives and prints from various sources. All these series are, however, open to various objections as a source of exact statistics.

First: Very few cases, relatively, have views in the two planes, and without both views it is often unwise to be too certain of details.

Second: Many skiagraphs are in themselves very imperfect, especially the earlier productions of a time when the technique was less reliable than to-day.

Third: Reproductions of skiagraphs for publication are usually very unsatisfactory.

For these reasons it seems unwise to attempt a detailed tabulation, and only the general deductions possible from the total will be attempted.[1] In general, the writer's conclusions would tally pretty closely with those of Kahleyss, whose X-ray series is the best published one at hand.

A majority of all cases seems to show some obliquity up and backward, but in most cases this is very slight. Sharp obliquity up and backward is distinctly unusual. Obliquity in the contrary direction seems to be an extreme rarity; the writer has not seen it shown in the skiagraph. From side to side the fracture line is usually nearly or quite transverse, but a moderate trend upward and outward is by no means unusual. Fractures running obliquely up and outward are not rare; the converse obliquity is, on the contrary, extremely uncommon. Separation of the radial styloid alone is by no means common, but hardly a rarity. The most usual height for the fracture is from three-quarters to one inch from the joint, and the great majority fall within or near this limit.

Comminution is frequent; it is not always easy to be certain of it unless there is spreading of the fragments; but it seems to occur in one-fourth to one-third of all cases, at least. (Kahleyss's estimate is 42 per cent.)

[1] Covering the series of Kahleyss, Beck, Freeman, Don, Haughton, Picard, Corson, and such unpublished plates and prints of his own and others as the writer has examined.

As to just what the lines of penetration into the joint are, the X-ray gives no information; but in a large number of the cases where the splitting of the posterior wall of the lower fragment is represented by a line, this line falls just about at the groove for the extensor secundi internodii pollicis. It cannot be asserted that this means a comminution in the fashion described by Bennett; but the findings are at least consistent with such a supposition. Few of the plates seem to warrant an interpretation of an anteroposterior splitting of the lower fragment, running clear through.

Displacement backward almost always occurs to some extent; displacement outward is frequent; but, save in the displacement of the outer portions of a smashed lower fragment, or in a few cases of marked upward and outward obliquity, it is rarely more than slight. Displacement forward is so rare, evidently, that it still remains a curiosity; and it seems an open question whether some of the considerable number of specimens of this deformity may not have had their origin in an over-zealous reduction. Displacement inward does occur (the writer has seen one such skiagraph), but it is a rarity, and the displacement trifling at that.

Entire absence of displacement is by no means rare.

Rotation backward is wellnigh universal when there is any displacement and occurs to a degree that seems in constant disproportion to what one feels in examining. A rotation of forty-five degrees or more, even in simple fractures, is not rare.

Rotation outward is the rule, though it is often present to slight degree only.

Impaction cannot be determined by the skiagraph; some shortening is common.

So far as the radius alone is concerned, the constantly recurring form is the transverse fracture about three-quarters inch up, simple, or if comminuted, then without much spreading of fragments, with moderate backward displacement and considerable backward rotation, without displacement, laterally, but with some rotation outward and upward.

As to the radio-ulnar connections, a broadening of the space between the bones, indicating ligamentous rupture, is present in a considerable number of cases; broadening of the wrist as a whole, whether from this cause, from comminution of the radius, or from tilting of the lower radial fragment up and out, is usually present in some degree.

As to the ulna, the familiar forward luxation is usual; practically, the only other lesion is the fracture of the ulnar styloid. This fracture occurs in a large proportion of the cases: according to Kahleyss 78 per cent; the skiagraphs examined by the writer show 40 per cent.; those of Beck 16 per cent. The average of all X-rays available gives just 50 per cent.

The forms of fracture of the styloid have already been considered.

Separations of the radial epiphysis, and especially separations without any notable displacement and incomplete separations seem to be rather common. On the other hand, fractures of one or both bones close to the intact epiphyseal line seem not to be unusual, especially in small children.

A consideration of the pathology of Colles's fracture would not be complete without some notice of the experimental evidence, unsatisfactory as it is.

The writer has, in his turn, attempted the experimental solution of the etiology of the various fracture-forms, and the number of more or less carefully recorded experiments in the literature is very large;[1] but it cannot be said that the evidence is conclusive. The different forces applied and the different conditions under which force is applied do not express themselves with any constancy in the fractures produced. It can, at most, only be said that such and such a lesion may be produced in this or that way, not that it is a constant result of a given procedure.

Transverse fractures were obtained by forced hyperex-

[1] In the majority of cases, however, the results of experiments are imperfectly recorded; hence, of fourteen articles recording experiments, there is little more in the way of data than is here put down.

tension by Schmit, by forced extension and by forced flexion as well by Hamilton.

Fractures oblique up and backward seem to be produced (experimentally) only by blows on the hand, or on the elbow with the hand fixed (so Weir and Kahleyss). Schmit, Weir, and Kahleyss all produced comminution by this or similar means (lever pressure) in a number of experiments: hyperextension does not produce comminution. Impaction, too, is to be produced only by a blow (Schmit). Fractures of the radial styloid and fractures oblique up and outward have been produced by hyperextension (Schmit, Lecomte, Hamilton). Separation of the epiphysis may be a result of hyperextension [1] (Schmit) or of forced flexion (Schmit, Roberts). Chipping of the posterior edge may result from hyperextension (Weir, Kahleyss), or may result from a blow on the elbow with the hand fixed (Kahleyss).

Fractures of the ulnar styloid seem to belong only to the smashing force applied in the axis of the bone, though Roberts produced this lesion in one case by forced flexion. Longitudinal fissures have been produced by Bennett by direct violence (rolling the wrapped-up wrist under his heel), while Kahleyss produced transverse fissures of the back surface by forced flexion.

Looked at from the side of the method used:

Force applied in the axis of the arm with mallet or lever produced fracture oblique up and back, or less usually chipping posteriorly, and produced comminution and impaction in some cases.

Forced hyperextension produced most inconstant lesions, including especially fractures of the radial styloid and of the anterior edge, as well as transverse fracture.

The writer's own experiments,[2] however, show as a result of hyperextension in each case an oblique fracture upward and

[1] This requires, as the writer has repeatedly found, only a minimal force in the new-born cadaver, and probably not much in the early years.

[2] Published in detail in the Journal of the Boston Society of the Medical Sciences, 1898, Vol. ii, p. 171.

forward,—a simple lifting off of the anterior portion of the joint surface by the anterior ligament, as Lecomte and Hamilton also found in some of their experiments. In applying force in the axis of the arm, however, whether by lever or with the mallet, the results were less constant; namely, two fractures oblique, up and back, three transverse (two of them comminuted, one " Barton's" fracture, and one irregular splitting of no definite type). There were two fractures of the ulnar styloid, both the result of force applied in the axis of the bone. Both the comminuted transverse fractures were split into the joint in the way described by Bennett.

The most obvious conclusion to be drawn from this showing is that the mechanism is neither simple nor constant; and this is borne out when we consider the evidence of clinical histories, for there are at least two recorded cases where a fall on the back of the hand produced a Colles's fracture with backward displacement (Cameron, Hamilton),[1] and other cases (Hennequin, and Roberts's Cases I and XI) where force received on the palmar side produced anterior displacement of the fragment. In practice, Colles's fracture is a result of falls on the palm of the hand, or, in some cases, of force applied to hand and elbow.[2] It seems probable that the prime factor is the crushing force taking effect at the weakest portion of the bone. Undoubtedly hyperextension alone may cause the fracture; at all events some fracture of the wrist, as in two cases by Voillemier and one of Jones where the fingers and the fore part of the palm received all the force. Probably hyperextension plays some part, a subordinate one, in many cases of fracture. The epiphyseal separations are probably more often so caused.

Comminution is evidently a result of the splitting of the lower fragment by the upper, and the break occurs more usu-

[1] In a case of the writer's with moderate silver-fork deformity—showing in the X-ray a comminuted transverse fracture—there was also a distinct history of a fall on the back of the hand.

[2] In the German mines this fracture is said to be frequently a result of crushing in this direction, the arm being caught between ore-cars as the miner is shoving one forward.

ally at the posterior edge where the greatest penetration is, and through the weakest parts of this region.

Probably fractures of the radial styloid and fractures oblique up and outward are produced by marked abduction of the hand at the moment of impact. In this way, too, as well as by the driving upward of the lower fragment, the rupture of the radio-ulnar ligaments, including the triangular fibro-cartilage, is to be explained.

The fracture of the ulnar styloid is evidently not a result of pull on the triangular cartilage (for both may give way together), but of the lateral ligament. The writer is inclined to suspect, however, that some cases of fracture of the ulnar styloid result from contact with the ground, when the ulna is luxated forward at the moment of impact.[1]

Now that the lesions occurring, their relative frequency and their probable causation have been considered, it would be most desirable to fix on certain broad types of Colles's fracture (since we can no longer speak of one type), types perhaps representing associated lesions due in each case to some peculiarity in the vulnerating forces. The writer has studied the data in vain for any satisfactory basis for such classification.

There is, perhaps, a type without marked deformity, a simple transverse fracture representing the simple giving way of an old bone under slight violence (for Schmit has demonstrated most satisfactorily the decreased power of resistance to fracture of the wrists of older subjects); there is a converse type, a comminuted fracture with much displacement and much damage to ligaments, representing the giving way of a bone that is young and strong and yields only to excessive trauma; there is, perhaps, also a type of fracture probably caused by impact with the hand in abduction or impact on the ulnar side of the palm, where there is upward and outward obliquity of the fracture line, or a fracture of the radial styloid, and more frequently than in other sorts, a fracture of the ulnar styloid; but these types are by no means constant in detail and by no means cover all cases.

[1] Tillmanns speaks of it as being crushed off.

On the whole, it is perhaps as sound simply to describe the lesions, and not to try to classify them in groups on the basis of such knowledge as we now have.

REFERENCES.

Beck: Medical News, 1898, Vol. lxxii, p. 231.

Bennett: British Medical Journal, 1880, Vol. i, p. 759; Ibid., 1892, Vol. i, p. 902; Dublin Journal of the Medical Society, 1881, Vol. lxxi, p. 372; Transactions of the Royal Academy of Medicine, Ireland, Vol. ix, 1890, p. 457, and Vol. x, 1891-92, p. 322.

Bruns: Langenbeck's Archiv, 1881, Band xxvii, 240.

Brünner: London Medical Record, 1886, p. 298.

Bulteau: Bull. de la Soc. Anatom., 1877, p. 382.

Callender: Glasgow Medical Journal, 1878, Vol. x, p. 197.

Cock: Guy's Hospital Reports, Third Series, Vol. vii, p. 262.

Don: British Medical Journal, 1897, Vol. i, p. 797.

Dupuytren: Quoted by Kahleyss.

Erichsen: Science and Art of Surgery, Sixth edition, Vol. i, p. 326 (quoted by Lucas).

Falkson: Centralb. f. Chirurgie, 1885, Band xii, 913.

Flower: Holmes's System of Surgery, Vol. ii, p. 801.

Freeman: ANNALS OF SURGERY, 1897, Vol. xxv, p. 471.

Gerard-Marchant: Rev. d'Orthopedie, 1894, v, 147.

Golobiewski: Vrtljhrsch. f. gerichtl. Med., 1894, vii, 122.

Gordon: Fractures of the Lower End of the Radius, London, 1875.

Hall: New York Medical Journal, 1886, Vol. xliii, p. 414.

Hamilton: Fractures and Dislocations, and New York Medical Record, 1881, Vol. xx, p. 107.

Haughton: British Medical Journal, 1897, Vol. i, p. 797.

Hecht: Münchner med. Wochensch., 1894, No. 32.

Helferich: Fractures and Dislocations.

Hennequin: Rev. de Chir., 1894, Vol. xiv.

Hunt: Annals of Anatomy and Surgery (Brooklyn), 1881, p. 110.

Hutchinson: British Medical Journal, 1866, June 30, and Illustrated Clinical Surgery, Vol. xix, Plate LXXI.

Jones: Liverpool Medico-Chirurgical Journal, 1885, Vol. v, p. 430.

Kahleyss: Deutsche Zeitsch. f. Chir., 1897, 533.

Lenoir: Arch. Gén. de Méd., 1839.

Letenneur: Bull. de la Soc. Anat., 1839, xiv, 162.

Löbker: Deutsche med. Wochensch., 1885, No. 27.

Lucas: Guy's Hospital Reports, 1883-84, Vol. xxvii.

McGraw and Walker: Annals of Anatomy and Surgery (Brooklyn), 1881.

Moore: New York Medical Record, 1880, Vol. xvii, p. 305.

Ogston: British Medical Journal, 1876, Vol. ii, p. 298.

Packard: Ashhurst International Cyclopædia of Surgery, Vol. vii, and American Journal of the Medical Sciences, 1879.

Di Paoli: Del distaccio traumatico delle epifisi, Torino, 1882 (cited by Poland).
Picard: Thèse de Paris, No. 457, 1898.
Pilcher: New York Medical Record, 1878, Vol. ii, p. 74.
Pilcher: Fracture of the Lower Extremity of the Radius, 1897.
Poland: Traumatic Separation of the Epiphyses, London, 1898.
D'Arcy Power: Transactions of the Pathological Society, London, 1887, Vol. xxxviii, p. 250.
Roberts: American Journal of the Medical Sciences, 1897, p. 10, and "Study, etc., of Fracture of Lower End of Radius," Philadelphia, 1897.
Rutherford: Glasgow Medical Journal, 1891, Vol. xxxv, p. 312.
Schmit: Thèse de Paris, 1878.
Schwartz: Rév. d'Orthopedie, 1898, Sept. 1.
Shattock: Transactions of the Pathological Society, London, 1889-90, Vol. xli, p. 236.
Smith: Fractures in Vicinity of Joints, 1847.
Stehr: Bruns's Beiträge, 1889, Band v, 595.
Stimson: Fractures and Dislocations, p. 449.
Thomas: British Medical Journal, June 2, 1897.
Voillemier: Arch. Gén. de Méd., 1839, vi, 401.
Westbrook: Annals of Anatomy and Surgery (Brooklyn), 1881, p. 113.
Wight: Pathologist (Brooklyn), 1881, p. 15, and Medical and Surgical Reporter, 1880, Vol. xliii, 141.

TETANUS.[1]

A STUDY OF THE NATURE, EXCITANT, LESIONS, SYMPTOMATOLOGY, AND TREATMENT OF THE DISEASE, WITH A CRITICAL SUMMARY OF THE RESULTS OF SERUM THERAPY.

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(CONTINUED FROM PAGE 250.)

No. 98.—*Name,* Blumenthal.[107] *Year,* 1896. *Diagnosis,* Tetanus puerperalis. *Period of incubation,* seven days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 30.0. *Make,* Boer. *Other treatment,* chloral. *Result,* death.

No. 99.—*Name,* Austin.[108] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* possibly caused by various scratches on arm. *Period of incubation,* about five days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* New York Board of Health. *Other treatment,* KBr, chloral. *Result,* recovery. *Remarks.* Author says that three hours after injection, the patient could open his mouth better; one and a half hours later still better, and was entirely cured next morning.

Of the symptoms mentioned, we find severe pains in the masseter muscle and teeth, which were firmly pressed together. Pain radiating from the condyles of the jaw along the bone to the second molar tooth, and from behind the ear to the clavicle; sore throat on swallowing.

(Judging from above description and from the rapid recovery (three hours), it appears more like a case of spurious lockjaw, possibly caused by some infection of the tonsil, or by a carious tooth (second molar)).

No. 100.—*Name,* Whitington.[109] *Year,* 1896. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* Abortion. *Period of incubation,* about

[1] Read at the meeting of the New York County Medical Society, April 23, 1900.

thirteen days. *Day of first injection,* twelfth day. *Method of administration,* subcutaneous. *Amount,* 90 cubic centimetres. *Make,* New York Institute Pasteur. *Other treatment,* KBr, chloral. *Result,* recovery. *Remarks.* Author argues distinctly for the correctness of the diagnosis as opposed to hysteria, in view of following facts:

(1) The initial prominence of the trismus and its persistence in the intervals of general spasms. (Does not necessarily and exclusively speak for tetanus.)

(2) The absence of all sensory disturbances and of other stigmata of hysteria. (Does not necessarily exclude hysteria.)

(3) The fair preservation of consciousness. (May occur also in hysteria.)

(4) The character of the temperature chart. (We have no characteristic temperature chart for tetanus.)

(5) The etiological relation. (Not every case of abortion is followed by tetanus.)

(Description of case sounds very much like hysteria.)

No. 101.—*Name,* Engelmann.[170] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of nose. *Period of incubation,* seven days. *Day of first injection,* seventeenth day. *Method of administration,* subcutaneous. *Amount,* 9.0. *Make,* Tizzoni. *Other treatment,* morphine, KBr, chloral. *Result,* recovery. *Remarks.* Author says that, judging from period of incubation, the case was bad; but from the progress, the case had a fair prognosis.

No. 102.—*Name,* Engelmann.[170] *Year,* 1897. *Diagnosis,* Tetanus(?). *Nature of injury,* no discoverable cause. *Period of incubation,* unknown. *Day of first injection,* thirteenth day. *Method of administration,* subcutaneous. *Amount,* 9.0. *Make,* Tizzoni. *Other treatment,* morphine, chloral, KBr. *Result,* recovery. *Remarks.* Judging from the symptoms, a bad case.

No. 103.—*Name,* Engelmann.[170] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of thumb. *Period of incubation,* nine days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* Behring. *Other treatment,* morphine. *Result,* recovery. *Remarks.* Tetanus bacilli found on the splinter. Author counts this case to the medium grave form. He will not say with certainty that recovery was due to the antitoxin, but it cannot be denied that there were good effects.

No. 104.—*Name,* Teichmann.[171] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot. *Period of incubation,* seven days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 5 cubic centimetres. *Make,* not stated. *Other treatment,* chloral. *Result,* recovery.

No. 105.—*Name,* Kortmann.[172] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound over knee. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* intravenous. *Amount,* 5 cubic centimetres. *Make,* not stated. *Other treatment,* chloral. *Result,* death. *Remarks.* Death followed very

rapidly, only twenty-seven hours after onset; injection five hours after making diagnosis.

No. 106.—*Name,* Jacob.[173] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* pistol-shot wound of shoulder. *Period of incubation,* twelve days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Behring. *Other treatment,* chloral. *Result,* recovery.

No. 107.—*Name,* Höfling.[174] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of little finger. *Period of incubation,* approximately nine days. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Behring. *Other treatment,* none. *Result,* recovery. *Remarks.* Little finger was amputated, but no internal medication was given.

No. 108.—*Name,* Merkel.[175] *Year,* 1897. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* introduction of bougie into uterus to induce abortion. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* not stated. *Amount,* not stated. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 109.—*Name,* Merkel.[175] *Year,* 1897. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* introduction of bougie into uterus to induce abortion. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* not stated. *Amount,* not stated. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 110.—*Name,* Hollis.[176] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of scalp. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 160 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* recovery.

No. 111.—*Name,* Beamish.[177] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of leg, followed by gangrene. *Period of incubation,* twelve days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 10 cubic centimetres. *Make,* not stated. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Amputation of leg. Though only ten cubic centimetres were injected and somewhat late in the disease, it was still followed by recovery. (Somewhat unusual.)

No. 112.—*Name,* McWatt.[178] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of thumb. *Period of incubation,* one week. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 60 grains. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says, a case with a very bad prognosis, and thinks recovery was due entirely to the antitoxin.

No. 113.—*Name,* Proudfoot.[179] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* numerous wounds on hand. *Period of incubation,* uncertain. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount* 3.0 and 20 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, oxygen, anæsthesia. *Result,* death. *Re-*

marks. Author says that he saw no benefit from the antitoxin, but also that possibly he used too little.

No. 114.—*Name,* Carter.[180] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of hand. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Insufficient report in both cases.

No. 115.—*Name,* Carter.[180] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury to finger. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 54 cubic centimetres. *Make,* French. *Other treatment,* chloral, gelsemium. *Result,* death.

No. 116.—*Name,* Blake.[181] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound, with opening into knee-joint. *Period of incubation,* eleven days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 99 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr. *Result,* death.

No. 117. *Name,* Smart.[182] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of finger. *Period of incubation,* nine days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, KBr. *Result,* recovery. *Remarks.* Author thinks that, though sedatives were used continuously, the symptoms were much alleviated by the antitoxin.

No. 118.—*Name,* Smythe.[183] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* ulcer of leg. *Period of incubation,* unknown. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 110 cubic centimetres. *Make,* British Institute of Preventive Medicine and Paris Institute Pasteur. *Other treatment,* chloral, KBr. *Result,* recovery. *Remarks.* Author does not want to say how much of the improvement was due to the antitoxin, but thinks that amelioration of the symptoms followed each injection.

No. 119.—*Name,* Turner.[184] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by a rusty nail. *Period of incubation,* fourteen days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 70 grains. *Make,* Tizzoni. *Other treatment,* chloral, KBr. *Result,* recovery. *Remarks,* Author says that, taking everything into consideration, this was a rather mild case, with a long period of incubation, and it appeared to him that the chloral had more effect than the antitoxin in controlling the spasms.

No. 120.—*Name,* Chapman.[185] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of forearm. *Period of incubation,* eighteen days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 360 grains. *Make,* not stated. *Other treatment,* not stated. *Result,* recovery. *Remarks,* Author says that the

part played by the antitoxin in the successful issue of the case is somewhat doubtful, as the prognosis was favorable from the first.

No. 121.—*Name,* Chalmers.[186] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* complete crushing of terminal phalanx of finger. *Period of incubation,* six days. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 15 grains, 53 grains. *Make,* Roux and Tizzoni respectively. *Other treatment,* chloral, KBr. *Result,* recovery. *Remarks.* Author thinks that improvement was particularly due to Tizzoni's antitoxin; not much effect from Roux's preparation.

No. 122.—*Name,* Blaker.[187] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of palm caused by a piece of glass. *Period of incubation,* twelve days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* not stated. *Other treatment,* chloral, opium, HgI_2 baths. *Result,* recovery. *Remarks,* Author places considerable importance upon the HgI_2 baths. (Why?)

No. 123.—*Name,* Marsack.[188] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot caused by a piece of glass. *Period of incubation,* eleven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 6.0. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, morphine. *Result,* recovery.

No. 124.—*Name,* Marsack.[188] *Year,* 1897. *Diagnosis,* T. (?). *Nature of injury,* cause not discovered. *Period of incubation,* unknown. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 3.0. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr. *Result,* recovery. *Remarks,* Author thinks that both were severe cases; he saw no improvement after the antitoxin, but believes it has some value, particularly if combined with chloral and KBr.

No. 125.—*Name,* Goldsmith.[189] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasion on dorsum of hand. *Period of incubation,* thirteen days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres, 90 grains. *Make,* Burroughs, Welcome & Co. and British Institute of Preventive Medicine respectively. *Other treatment,* chloral, KBr, morphine. *Result,* recovery. *Remarks.* Author will not say what share the antitoxin had in the recovery. Judging from the symptoms, it was a bad case.

No. 126.—*Name,* McCausland.[190] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasions on legs. *Period of incubation,* one day. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* recovery. *Remarks.* A poorly reported case; and, although author argues for it, the diagnosis is not by any means proven. The onset was too rapid, and also the recovery; patient being better in one day.

No. 127.—*Name,* Plücker.[191] *Year,* 1897. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* injury of eye by kick of a horse, with fracture

of orbit and injury of brain. *Period of incubation,* eleven days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death. *Remarks.* Autopsy revealed nothing of importance; not even meningitis.

No. 128.—*Name,* Trapp.[192] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of scalp. *Period of incubation,* five days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 6.75. *Make,* Tizzoni. *Other treatment,* KBr. *Result,* recovery. *Remarks.* Author considers it a very bad case, but judging from the description of the symptoms, not from the period of incubation, it does not appear to be a very bad case. Author thinks recovery was due to the antitoxin.

No. 129. *Name,* Suter.[193] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of toe. *Period of incubation,* eleven days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 5.0, 15 cubic centimetres. *Make,* Behring, Bern make. *Other treatment,* chloral, opium, morphine. *Result,* recovery. *Remarks,* Author considers it a mild case from the beginning.

No. 130.—*Name,* Suter.[193] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of thumb. *Period of incubation,* about four weeks. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 15.0. *Make,* Behring. *Other treatment,* chloral, morphine, KBr. *Result,* death. *Remarks.* Author says a very bad case in spite of unusually long period of incubation. When the patient died, the wound was totally healed, but at autopsy Tetanus bacilli were found in the cicatrix (very interesting, almost unique).

No. 131.—*Name,* Suter.[193] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of hand. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 2 bottles. *Make,* Bernese serum antitetanique. *Other treatment,* chloral and morphine, venesection. *Result,* death. *Remarks,* Also a very bad case, particularly if symptoms and progress are taken into consideration.

No. 132.—*Name,* Wendling.[194] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of bridge of nose. *Period of incubation,* not stated. *Day of first injection,* about tenth day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Behring. *Other treatment,* morphine, chloral, etc. *Result,* recovery. *Remarks,* Author says that, although this case was of the more chronic form, it was still very desolate and bad; and says undoubtedly it was the antitoxin which saved this patient from untimely death.

No. 133.—*Name,* Rudis-Jicinsky.[195] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of thigh caused by a boar's bite. *Period of incubation,* five and one-half hours. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* about 200 cubic centimetres. *Make,* not stated. *Other treatment,* morphine, KBr, anæsthesia. *Result,* recovery. *Remarks.* An exceedingly short period of incubation.

No. 134.—*Name,* Asam.[196] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot. *Period of incubation,* about three weeks. *Day of first injection,* second day. *Method of administration,* intravenous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* chloral and morphine. *Result,* recovery. *Remarks.* Author thinks recovery was due to the antitoxin, and urges its continued trial.

No. 135.—*Name,* Weischer.[197] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of finger. *Period of incubation,* four days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Behring. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Author says recovery was undoubtedly due to the antitoxin.

No. 136.—*Name,* Coffin.[198] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of hand caused by a piece of bone. *Period of incubation,* four days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 1800 cubic centimetres. *Make,* Parke, Davis & Co. *Other treatment,* chloral, NaBr, morphine. *Result,* recovery. *Remarks.* Author and others who have seen the case agree that patient could not have recovered without the use of the antitoxin. (Large quantity used.)

No. 137.—*Name,* Foster.[199] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot caused by a nail. *Period of incubation,* one week. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 80 cubic centimetres. *Make,* Parke, Davis & Co. *Other treatment,* chloral, KBr, morphine, cannabis, hyoscyamus. *Result,* recovery.

No. 138.—*Name,* Fauser.[200] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of finger. *Period of incubation,* not given in reference. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 80 cubic centimetres. *Make,* Preisz. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Original (Orvosi Hetilap) not obtainable.

No. 139.—*Name,* Réczey.[201] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of hand caused by bite of monkey, and later infected by dissecting a horse dead of tetanus. *Period of incubation,* two days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* not stated. *Other treatment,* chloral, pilocarpine. *Result,* recovery. *Remarks.* Author thinks that the short period of incubation and the remarkable rapidity were due to the absorption of already existing tetanus toxins from the tetanic horse. (Good recovery! ! from a bad case.)

No. 140.—*Name,* Rubeska.[202] *Year,* 1897. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* induced abortion for placenta prævia. *Period of incubation,* about nine days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 0.2 every five hours. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death. *Remarks.* Death followed nine days after onset of symptoms.

No. 141.—*Name,* Rubeska.[202] *Year,* 1897. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* normal delivery. *Period of incubation,* nine-

teen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death.

No. 142.—*Name,* Steiner.[203] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of thumb. *Period of incubation,* eleven days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 4.5. *Make,* Tizzoni. *Other treatment,* chloral, morphine, sulphonal. *Result,* recovery.

No. 143.—*Name,* Bargelessi.[204] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury to hand. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration.* subcutaneous. *Amount,* 5.0. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery.

No. 144.—*Name,* Bargelessi.[204] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury to foot. *Period of incubation,* nine days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 6.0. *Make,* Tizzoni. *Other treatment,* chloral and morphine. *Result,* recovery. *Remarks.* Very bad case, followed by recovery.

No. 145.—*Name,* Frassi.[205] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* extensive injury of leg. *Period of incubation,* fifteen days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 3.9. *Make,* Tizzoni. *Other treatment,* chloral and KBr. *Result,* recovery. *Remarks.* Very bad case in spite of long period of incubation.

No. 146.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot caused by a nail. *Period of incubation,* five days. *Day of first injection,* second day. Method *of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* recovery.

No. 147.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of foot. *Period of incubation,* about four weeks. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* recovery.

No. 148.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of foot. *Period of incubation,* four to five days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 3 injections. *Make,* Parke, Davis & Co. *Other treatment,* chloral, bromide. *Result,* recovery.

No. 149.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* traumatic ulcer of foot. *Period of incubation,* about two weeks. *Day of first injection,* sixth day...*Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* recovery.

No. 150.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of lip and face. *Period of incubation,* five days. *Day of first injection,* second day. *Method of administration,*

subcutaneous. *Amount,* 60 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* recovery.

No. 151.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of thigh. *Period of incubation,* eleven days, *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* death.

No. 152.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of foot. *Period of incubation,* eleven days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide, physostigmine. *Result,* death.

No. 153.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of hand. *Period of incubation,* fourteen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 62 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* none purposely. *Result,* recovery.

No. 154.—*Name,* Archmard.[206] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of thumb. *Period of incubation,* less than twelve days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* recovery.

No. 155.—*Name,* Rose.[207] *Year,* 1897. *Diagnosis,* Tetanus(?). *Nature of injury,* cause not discovered. *Period of incubation,* unknown. *Day of first injection,* fourth day. *Method of administration,* intravenous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* opium, chloral. *Result,* recovery. *Remarks,* mild case.

No. 156.—*Name,* Rose.[207] *Year,* 1897. *Diagnosis,* Tetanus neonatorum. *Nature of injury,* infection of umbilicus. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* not stated. *Result,* death.

No. 157.—*Name,* Boinet.[208] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* numerous scratches on skin; possibly also through respiratory tract. *Period of incubation,* unknown. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 100 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* recovery.

No. 158.—*Name,* Lardy.[209] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot, caused by nail. *Period of incubation,* fifteen days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral. *Result,* recovery.

No. 159.—*Name,* Steer.[210] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by a shoe-nail. *Period of incubation,* about two weeks. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* about 130 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral and bromide. *Result,* recovery.

No. 160.—*Name,* Grayson.[211] *Year,* 1896. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by a wire. *Period of incubation,* seven to eight days. *Day of first injection,* twelfth day. *Method of administration,* subcutaneous. *Amount,* 25 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, bromide. *Result,* recovery. *Remarks.* Apparently a mild case in spite of short period of incubation.

No. 161.—*Name,* Gouley.[212] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* shot wound of finger. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 162.— *Name,* Cavandoli.[213] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of foot. *Period of incubation,* ten days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 13.5. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery.

No. 163.—*Name,* Rabek.[214] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of great toe. *Period of incubation,* seven days. *Day of first injection,* seventh day *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* purposely none. *Result,* recovery.

No. 164.— *Name,* Owens and Porter.[215] *Year,* 1897. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* extensive laceration of face and scalp. *Period of incubation,* seven days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 90 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, NaBr, physostigmine. *Result,* death. *Remarks.* Author says that the antitoxin injections apparently exerted no influence upon the tetanic symptoms.

No. 165.—*Name,* Owens and Porter.[215] *Year,* 1897. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of index. *Period of incubation,* eight days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 30 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromide. *Result,* death.

No. 166.—*Name,* Tauber.[216] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of great toe. *Period of incubation,* not stated. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Behring. *Other treatment,* chloral. *Result,* death.

No. 167.—*Name,* Reinhard.[217] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of hand, with subsequent amputation. *Period of incubation,* twenty-four(?) days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 120 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Quite a long period of incubation; etiology is also uncertain, caused either by the original injury or by the operation. Author says that improvement always set in five or six hours after each injection.

No. 168.—*Name,* Möller.[218] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* tearing off of hand and part of forearm. *Period of incubation,* thirteen days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* 4.5. *Make,* Tizzoni. *Other treatment,* morphine. *Result,* recovery. *Remarks.* Author says that improvement was always noted five or six hours after each injection.

No. 169.—*Name,* Erdheim.[219] *Year,* 1898. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* small ulcer on cheek. *Period of incubation,* thirteen days. *Day of first injection,* second day. *Method of administration,* intravenous, subcutaneous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* death. *Remarks.* Author says that prognostically the first case was better than the second.

No. 170.—*Name,* Erdheim.[219] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of heel. *Period of incubation,* five days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Behring. *Other treatment,* not stated. *Result,* death.

No. 171.—*Name,* Krokiewitz.[220] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Period of incubation,* seven days. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 195.0. *Make,* not stated. *Other treatment,* chloral, KI, hyoscyamine, morphine. *Result,* recovery. *Remarks.* Author is more in favor of the injection of a calf's brain emulsion, believing, with Ehrlich and Wassermann and Takaki, that the brain has a certain tetanus antitoxic power.

No. 172.—*Name,* Bruno.[221] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of finger. *Period of incubation,* four days. *Day of first injection,* third day. *Method of administration,* subcutaneous, intravenous. *Amount,* 500 units, 25 units. *Make,* Behring. *Other treatment,* morphine. *Result,* death. *Remarks.* In the summary of his three cases, author says he saw no improvement in either case. On the contrary, all the patients became worse after the injection; although in the second and third case the injections were given very early in the disease.

No. 173.—*Name,* Bruno.[221] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* nine days. *Day of first injection,* second day. *Method of administration,* intravenous. *Amount,* 500 units. *Make,* Behring. *Other treatment,* morphine, chloral. *Result,* death.

No. 174.—*Name,* Bruno.[221] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* intravenous. *Amount,* 500 units. *Make,* Behring. *Other treatment,* not stated. *Result,* death.

No. 175.—*Name,* Schubert.[222] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of second phalanx. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* intravenous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* morphine and chloral. *Result,* death.

No. 176.—*Name,* Schubert.[222] *Year,* 1898. *Diagnosis,* Tetanus trau-

maticus. *Nature of injury,* lacerated wound of foot. *Period of incubation,* seven days. *Day of first injection,* tenth hour. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* morphine. *Result,* death. *Remarks.* Injection made in this case very early, only ten hours, but patient died in spite of it.

No. 177.—*Name,* Hale.[223] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasion of nose. *Period of incubation,* thirteen days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 210 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, NaBr, morphine, atropine. *Result,* recovery.

No. 178.—*Name,* Morgan.[224] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of eyelid. *Period of incubation,* seven days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, KBr, anæsthetics. *Result,* death.

No. 179.—*Name,* Barrow.[225] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of thumb. *Period of incubation,* about three weeks. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* British Institute of Preventive Medicine. *Other treatment,* KBr, bromidia. *Result,* recovery.

No. 180.—*Name,* Trevithick.[226] *Year,* 1898. *Diagnosis,* Tetanus(?). *Nature of injury,* cause not discovered. *Period of incubation,* unknown. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 30 cubic centimetres. *Make,* not stated. *Other treatment,* KBr, chloral, anæsthesia. *Result,* death. *Remarks.* From the description of the case, the diagnosis does not appear to be certain.

No. 181.—*Name,* Willett.[227] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of finger. *Period of incubation,* about sixteen days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 90 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* No improvement was noticed while the injections were given; after discontinuing it, chloral was given with good effect.

No. 182.—*Name,* Sime.[228] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of hand. *Period of incubation,* ten days. *Day of first injection,* ninth day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, morphine, opium, KBr, cannabis indica. *Result,* recovery.

No. 183.—*Name,* Stoneham.[229] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* extensive injury of forearm. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 35 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr. *Result,* death. *Remarks.* Tetanus bacilli found and cultivated

No. 184.—*Name,* Brooks.[230] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contused wound of thumb. *Period of incubation,* ten days. *Day of first injection,* second day. *Method of administra-*

tion, subcutaneous. *Amount*, 170 cubic centimetres. *Make*, Paris Institute Pasteur. *Other treatment*, chloral, morphine, bromides. *Result*, recovery.

No. 185.—*Name*, Patteson.[231] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, not stated. *Period of incubation*, eleven days. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, 230 cubic centimetres. *Make*, Paris Institute Pasteur. *Other treatment*, not stated. *Result*, recovery.

No. 186.—*Name*, Patteson.[231] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, not stated. *Period of incubation*, twelve days. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, 180 cubic centimetres. *Make*, Paris Institute Pasteur. *Other treatment*, not stated. *Result*, recovery.

No. 187. *Name*, Hy. Croly.[232] *Year*, 1898. *Diagnosis*, Tetanus cephalicus. *Nature of injury*, not stated. *Period of incubation*, shortly after. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, not stated. *Make*, not stated. *Other treatment*, not stated. *Result*, recovery.

No. 188.—*Name*, Hy. G. Croly.[233] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, not stated. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Other treatment*, not stated. *Result*, death.

No. 189.—*Name*, Denham.[234] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, not stated. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, not stated. *Make*, not stated. *Other treatment*, not stated. *Result*, death.

No. 190.—*Name*, Myles.[235] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, not stated. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, not stated. *Make*, not stated. *Other treatment*, not stated. *Result*, recovery.

No. 191.—*Name*, McCausland.[236] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, not stated. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, one injection. *Make*, some French make. *Other treatment*, bromidia. *Result*, recovery. *Remarks*. Questionable case.

No. 192.—*Name*, Curnow.[237] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, injury of thumb. *Period of incubation*, four days. *Day of first injection*, fourth day. *Method of administration*, subcutaneous. *Amount*, 30 cubic centimetres. *Make*, British Institute of Preventive Medicine. *Other treatment*, not stated. *Result*, death. *Remarks*. Tetanus bacilli found at seat of injury.

No. 193.—*Name*, Greenwood.[238] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, chronic ulcer of leg. *Period of incubation*, unknown. *Day of first injection*, fourth day. *Method of administration*, subcutaneous. *Amount*, 13.5 cubic centimetres. *Make*, Tizzoni. *Amount*, 180 cubic centimetres. *Make*, British Institute of Preventive Medicine. *Other treatment*, chloral, KBr, morphine, anæsthesia. *Result*, recovery.

No. 194.—*Name,* Greenwood.[238] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* chronic ulcer of leg. *Period of incubation,* unknown. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 100 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, bromidia, morphine. *Result,* death.

No. 195.—*Name,* Mixter.[239] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of foot, caused by a piece of glass. *Period of incubation,* eight days. *Day of first injection,* second day. *Method of administration,* subcutaneous and intravenous. *Amount,* 3290 cubic centimetres. *Make,* Massachusetts State Board, and 100 cubic centimetres. *Make,* Gibier. *Other treatment,* morphine, KBr, chloral, paraldehyde, anæsthesia. *Result,* recovery. *Remarks.* Author says this was not a chronic case, and that cases of similar severity in the Massachusetts General Hospital usually died; he also says that the antitoxin was responsible for the recovery. According to author, the serum used was a weak preparation; stronger ones would be better; but even the weak ones are good, provided only sufficient is used (3290!).

No. 196.—*Name,* Lund.[240] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound over occiput and malar bone. *Period of incubation,* five days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 470 cubic centimetres. *Make,* Massachusetts State Board of Health. *Other treatment,* KBr. *Result,* recovery. *Remarks.* Author does not class this case with the acute ones, in spite of short period of incubation.

No. 197.—*Name,* Lund.[240] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of toe, caused by stepping on a nail. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 400 cubic centimetres. *Make,* Massachusetts State Board of Health. *Other treatment,* morphine. *Result,* death.

No. 198.—*Name,* Homans.[241] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of legs, with subsequent amputation. *Period of incubation,* nine days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 260 cubic centimetres. *Make,* Roux, and 240 cubic centimetres. *Make,* Massachusetts State Board. *Other treatment,* morphine, chloral, anæsthesia. *Result,* death. *Remarks.* Tetanus bacilli found in the pus.

No. 199.—*Name,* Homans.[241] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of legs, with subsequent amputation. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 80 cubic centimetres. *Make,* Massachusetts State Board. *Other treatment,* not stated. *Result,* death.

No. 200.—*Name,* Riese.[242] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* scratch injury of chin. *Period of incubation,* unknown. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 7.0. *Make,* Behring. *Other treatment,* not stated.

Result, recovery. *Remarks.* Author says it was undoubtedly a bad case, and cure can be ascribed only to the antitoxin.

No. 201.—*Name,* Beuthner.[243] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of foot by stepping on glass. *Period of incubation,* five and a half days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* chloral. *Result,* death. *Remarks.* Author says it was a very bad case, but also that the antitoxin had no effect on the bad result.

No. 202.—*Name,* Patteson.[244] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by stepping on a thorn. *Period of incubation,* eleven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 15 grains. *Make,* not stated. *Amount,* 240 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, KBr. *Result,* recovery. *Remarks.* Author says that neither of these cases was very bad, but he has seen similar cases run a fatal course.

No. 203.—*Name,* Patteson.[244] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury to knee. *Period of incubation,* about a fortnight. *Day of first injection,* soon. *Method of administration,* subcutaneous. *Amount,* 130 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral and bromidia. *Result,* recovery.

No. 204.—*Name,* Patteson.[245] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by stepping on a nail. *Period of incubation,* about thirty hours. *Day of first injection,* at once. *Method of administration,* subcutaneous. *Amount,* 10 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, KBr. *Result,* death. *Remarks.* The following points are remarkable about this case:

(1) The terrible suddenness of the onset within thirty hours after the trauma.

(2) The inefficiency of the serum, though used early and frequently.

(3) Excised skin around wound showed almost a pure culture of tetanus bacilli.

No. 205.—*Name,* Potechin.[246] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* not stated. *Amount,* not stated. *Make,* not stated. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Only a small reference. Original. *Djetskaja Medicina,* 1898, Nos. 4 and 5, not obtainable.

No. 206.—*Name,* Carbognin.[247] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot. *Period of incubation,* ten days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 9.0. *Make,* Tizzoni. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Author says that he has no doubt that the recovery was due to the antitoxin.

No. 207.—*Name,* Heddaeus.[248] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of elbow. *Period of incuba-*

tion, nine days. *Day of first injection,* fifth day. *Method of administration,* intravenous. *Amount,* 15.0. *Make,* Behring. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says this case was a medium grave one, with a poor prognosis; the antitoxin doubtlessly had a good effect.

No. 208.—*Name,* Heddaeus.[248] *Year,* 1898. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* numerous wounds of face, caused by an explosion. *Period of incubation,* four and a half days. *Day of first injection,* at once. *Method of administration,* intravenous, subcutaneous. *Amount,* 5.0, 5.0 respectively. *Make,* Behring. *Other treatment,* chloral, opium. *Result,* recovery. *Remarks.* Author counts this case to the grave ones, and says that it is undeniable that in this case also the antitoxin had a distinct curative effect and patient was saved only by its use.

No. 209.—*Name,* Heddaeus.[248] *Year,* 1898. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* slight injury of lower lip, caused by a whip. *Period of incubation,* five days. *Day of first injection,* second day. *Method of administration,* intravenous. *Amount,* 50 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, opium, morphine. *Result,* death. *Remarks.* Author counts this case to the very grave ones, but says this case should not speak against the use of antitoxin, because it was used too late, and in insufficient amount.

No. 210.—*Name,* Bousquet.[249] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of hand. *Period of incubation,* eight days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 120 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral. *Result,* recovery.

No. 211.—*Name,* Koehler.[250] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of thigh. *Period of incubation,* eight days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring. *Amount,* 4.5. *Make,* Tizzoni. *Other treatment,* morphine. *Result,* death.

No. 212.—*Name,* Koehler.[250] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* probably an ulcer of tongue. *Period of incubation,* unknown. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 4.5. *Make,* Tizzoni, and 1000 units. *Make,* Behring. *Other treatment,* not stated. *Result,* death.

No. 213.—*Name,* Koehler.[250] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* ulcer of leg. *Period of incubation,* unknown. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 75 cubic centimetres. *Make,* Behring. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Mild case.

No. 214.—*Name,* Stintzing.[251] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of thigh. *Period of incubation,* eight days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring, and 4.5. *Make,* Tizzoni. *Other treatment,* morphine. *Result,* death.

No. 215.—*Name,* Stintzing.[251] *Year,* 1898. *Diagnosis,* Tetanus(?). *Nature of injury,* seat not found. *Period of incubation,* unknown. *Day of first injection,* fifth day. *Method of administration,* subcutaneous.

Amount, 4.5. *Make*, Tizzoni. *Amount*, 10.0. *Make*, Behring. *Other treatment*, not stated. *Result*, death.

No. 216.—*Name*, Barth.[252] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, excoriations on body. *Period of incubation*, seven days. *Day of first injection*, second day. *Method of administration*, subcutaneous. *Amount*, 300 cubic centimetres. *Make*, Roux. *Other treatment*, chloral and KBr. *Result*, recovery.

No. 217.—*Name*, Capelli.[253] *Year*, 1898. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, gunshot wound of shoulder. *Period of incubation*, fourteen days. *Day of first injection*, fifth day. *Method of administration*, subcutaneous. *Amount*, 3,600,000 units. *Make*, Tizzoni. *Other treatment*, chloral, Baccelli. *Result*, recovery.

No. 218.—*Name*, de Yoanna.[254] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, injury of finger. *Period of incubation*, eight days. *Day of first injection*, ninth day. *Method of administration*, subcutaneous. *Amount*, 280 cubic centimetres. *Make*, New York Board of Health. *Other treatment*, chloral, morphine. *Result*, recovery.

No. 219.—*Name*, H. Copley.[255] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Period of incubation*, ten days. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Amount*, begins with 30 cubic centimetres, and repeated two or three times a day. *Make*, Tizzoni. *Other treatment*, KBr. *Result*, recovery.

No. 220.—*Name*, H. Copley.[255] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Make*, Tizzoni and British Institute of Preventive Medicine. *Result*, recovery.

No. 221.—*Name*, H. Copley.[255] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Make*, British Institute of Preventive Medicine. *Result*, recovery.

No. 222.—*Name*, H. Copley.[255] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Period of incubation*, not stated. *Day of first injection*, not stated. *Method of administration*, subcutaneous. *Make*, British Institute of Preventive Medicine. *Result*, death. *Remarks*. Author says that the antitoxin was used too late in this case.

No. 223.—*Name*, Clark.[256] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, punctured wound of finger. *Period of incubation*, six days. *Day of first injection*, second day. *Method of administration*, subcutaneous. *Amount*, 50 cubic centimetres. *Make*, not stated. *Other treatment*, chloral and KBr. *Result*, death.

No. 224.—*Name*, Galletly.[257] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, lacerated wound of finger. *Period of incubation*, nineteen days. *Day of first injection*, second day. *Method of administration*, subcutaneous. *Amount*, 240 cubic centimetres. *Make*, British Institute of Preventive Medicine. *Other treatment*, chloral and KBr. *Result*, recovery. *Remarks*. Evidently a mild case.

No. 225.—*Name*, Marshall.[258] *Year*, 1899. *Diagnosis*, Tetanus traumaticus. *Nature of injury*, burn. *Period of incubation*, fourteen days. *Day of first injection*, not stated. *Method of administration*, subcutane-

ous. *Amount,* 110 cubic centimetres. *Make,* not stated. *Other treatment,* chloral and KBr. *Result,* recovery. *Remarks.* Author believes that the antitoxin was the principal curative agent, and says it is particularly useful in the more chronic cases, *i.e.,* in those with a period of incubation of more than ten days.

No. 226.—*Name,* Berry.[259] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of great toe. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 35 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr, morphine. *Result,* death. *Remarks.* Death twenty-seven hours after onset.

No. 227.—*Name,* Wace.[260] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of leg. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, KBr, morphine. *Result,* death. *Remarks.* Patient died only eleven hours after onset; evidently a very acute onset.

No. 228.—*Name,* Taylor.[261] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* abortion. *Period of incubation,* about five days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10 cubic centimetres. *Make,* Parke, Davis & Co. *Other treatment,* curettage, chloral, KBr. *Result,* recovery. *Remarks.* Although author argues for it, judging from the description of the case, the diagnosis is not by any means certain.

No. 229.—*Name,* Cane.[262] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound dislocation of phalanx. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral, KBr. *Result,* death.

No. 230.—*Name,* Mackey.[263] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushing of little finger. *Period of incubation,* two weeks. *Day of first injection,* one week. *Method of administration,* subcutaneous. *Amount,* about 120 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* very little chloral, KBr. *Result,* recovery. *Remarks.* Author says in this case the antitoxin was given a good trial, as very little medication was used.

No. 231.—*Name,* Mills.[264] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of heel. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 30 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* bromidia, KBr, chloral, opium. *Result,* death. *Remarks.* Author thinks that the amount used was too small, as it appeared to him that the antitoxin certainly did some good.

No. 232.—*Name,* Rice.[265] *Year,* 1899. *Diagnosis,* Tetanus(?). *Nature of injury,* stomatitis(?). *Period of incubation* (?). *Day of first injection,* on day of absolute diagnosis. *Method of administration,* subcutaneous. *Amount,* 110 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, bromidia. *Result,* recovery.

No. 233.—*Name,* Fraser.[266] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* scalp wound. *Period of incubation,* fifteen days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 80 cubic centimetres. *Make,* British Institute of Preventive Medicine. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author thinks it is highly probable that the good result was due to the antitoxin.

No. 234.—*Name,* James.[267] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of palm. *Period of incubation,* six days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* not stated, approximately 1245 cubic centimetres. *Make,* not stated. *Other treatment,* gelsemium. *Result,* recovery. *Remarks.* Enormous quantity of antitoxin used; regrettable that make is not stated.

No. 235.—*Name,* Adams.[268] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of palm. *Period of incubation,* thirteen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 150 cubic centimetres. *Make,* not stated. *Other treatment,* KBr. *Result,* recovery. *Remarks.* The bromide was used only on one day, but it had no effect on the spasms.

No. 236.—*Name,* Packard.[269] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* blank cartridge injury of hand. *Period of incubation,* seven days. *Day of first injection,* not stated. *Method of administration,* not stated. *Amount,* not stated. *Make,* not stated. *Other treatment,* physostigma, bromidia, chloral, morphine. *Result,* death.

No. 237.—*Name,* Packard.[269] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of thigh. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* not stated. *Amount,* not stated. *Make,* not stated. *Other treatment,* bromidia, physostigma, Baccelli. *Result,* death.

No. 238.—*Name,* Wagoner.[270] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of foot. *Period of incubation,* thirteen days. *Day of first injection,* fourteenth day. *Method of administration,* subcutaneous. *Amount,* 30.0. *Make,* not stated. *Other treatment,* cocaine, chloral, Baccelli. *Result,* recovery. *Remarks.* This case is of hardly any value in the statistics of antitoxin treatment, as it is possible that the long-continued carbolic injections were the cause of the recovery.

No. 239.—*Name,* Arneill.[271] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by stepping on a rusty nail. *Period of incubation,* eight days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 90 cubic centimetres. *Make,* Parke, Davis & Co. *Other treatment,* KBr, chloral, morphine. *Result,* death. *Remarks.* Author concludes by saying, "The failure of the antitoxin to relieve any of the symptoms should be emphasized." He also reports a case of pharyngeal abscess, diagnosed as tetanus, and warns from this mistake.

No. 240.—*Name,* Moeller.[272] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of foot, caused by an iron spike. *Period of incubation,* six days. *Day of first injection,* eighth day.

Method of administration, subcutaneous. *Amount,* 28 cubic centimetres. *Make,* Behring. *Other treatment,* morphine. *Result,* death. *Remarks.* Patient died on day of injection.

No. 241.—*Name,* Werner.[273] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of thumb. *Period of incubation,* six days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 31.5. *Make,* Behring. *Other treatment,* morphine, chloral. *Result,* death. *Remarks.* Tetanus bacilli found in the wound. Author says that the prognosis was very doubtful from the beginning, and that the chances for recovery poor, as the antitoxin was obtained too late.

No. 242.—*Name,* Hönn.[274] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of finger. *Period of incubation,* ten days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* one dose. *Make,* Tizzoni, and one dose. *Make,* Behring. *Other treatment,* morphine, chloral. *Result,* recovery. *Remarks.* Author will not say how much and whether the antitoxin aided in the recovery.

No. 243.—*Name,* Wullenweber.[275] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasion on back of hand. *Period of incubation,* two to three weeks. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 75 cubic centimetres. *Make,* not stated. *Other treatment,* chloral, etc. *Result,* recovery. *Remarks.* A long period of incubation, but in spite of this a very bad case and patient was once thought to be dying. Author also says that, without detracting from the antitoxin, the chloral bore a great share in the recovery, but it alone would not have saved the patient, and credit should be given to both.

No. 244.—*Name,* Engelien.[276] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of finger. *Period of incubation,* five days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Author says that, judging from the period of incubation and the cause, he should say this was a very bad case, and that other cases of same severity in his experience died. Good result was due to the antitoxin, and its continued use is urged.

No. 245.—*Name,* Kleine.[277] *Year,* 1899. *Diagnosis,* Tetanus(?). *Nature of injury,* inflamed nævus of thigh. *Period of incubation,* unknown. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 112 cubic centimetres. *Make,* Behring. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Tetanus bacilli found in the excised nævus.

No. 246.—*Name,* Kleine.[277] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of foot. *Period of incubation.* two or three weeks. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 40 cubic centimetres. *Make,* Behring. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Case was very bad

in spite of long period of incubation; cure was due solely to the antitoxin.

No. 247.—*Name,* Pitha.[278] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* forceps delivery and suture of perineum. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 22.0. *Make,* Tizzoni. *Other treatment,* chloral, anæsthesia. *Result,* death. *Remarks.* Tetanus bacilli found in the lochiæ.

No. 248.—*Name,* Pitha.[278] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* breech delivery. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 20.0. *Make,* Tizzoni. *Other treatment,* chloral, anæsthesia. *Result,* death. *Remarks.* Tetanus bacilli found in the lochiæ. Previously to these two cases there was another case of puerperal tetanus in the same (Pawlik's) clinic, and it is presumable that these two cases were infected by a double current catheter used on all, in spite of the fact that it was sterilized by boiling; possible that the boiling was insufficient to kill the tetanus spores.

No. 249.—*Name,* Pitha.[278] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* craniotomy. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 530.0. *Make,* Bujwid. *Other treatment,* not stated. *Result,* death. *Remarks.* Tetanus bacilli found in the extirpated uterus. Author thinks it is possible that this case was also infected from the previous one.

No. 250.—*Name,* Pitha.[278] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* forceps delivery and suture of perineum. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 100.0. *Make,* Bujwid. *Other treatment,* not stated. *Result,* death. *Remarks.* No tetanus bacilli were found in the extirpated uterus, but they were found in the perineal wound. Author says it is not impossible that, in spite of all precautions, this case was also infected from the previous ones.

No. 251.—*Name,* Pitha.[278] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* low forceps. *Period of incubation,* six days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* not stated. *Result,* death. *Remarks.* Patient was removed from the clinic.

No. 252.—*Name,* Gessner.[279] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* burn of second and third degree. *Period of incubation,* eight days. *Day of first injection,* sixth day. *Method of administration,* subcutaneous. *Amount,* 80.0. *Make,* Behring. *Other treatment,* morphine. *Result,* death. *Remarks.* Case treated in 1893.

No. 253.—*Name,* Gessner.[279] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound over temporal region. *Period of incubation,* nine days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 15 cubic centimetres. *Make,* Behring. *Other treatment,* morphine, chloral, anæsthesia. *Result,* death.

No. 254.—*Name,* Slawyk.[280] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of foot. *Period of incubation,*

not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous and lumbar. *Amount,* not stated. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death. *Remarks.* Guinea-pig infected with the splinter died in sixteen hours of tetanus.

No. 255.—*Name,* Czylharz.[281] *Year,* 1899. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* injury of scalp. *Period of incubation,* fourteen days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Tizzoni. *Other treatment,* chloral and KBr. *Result,* recovery. *Remarks.* Original not found. Referat in *Berliner klinische Wochenschrift,* 1899, p. 62. Author says cure was not entirely due to the antitoxin, as good effect was seen also from the chloral.

No. 256.—*Name,* Holsti.[282] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* incised wound of thumb. *Period of incubation,* three to four weeks. *Day of first injection,* sixteenth day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* A very chronic and mild case with long period of incubation.

No. 257.—*Name,* Holsti.[283] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot. *Period of incubation,* two weeks. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Also a mild and chronic case. Author says he saw no marked effect from the antitoxin.

No. 258.—*Name,* Thieme.[283] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of orbit and eyelids. *Period of incubation,* four days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 2.5. *Make,* Behring. *Other treatment,* not stated. *Result,* death. *Remarks.* Death only a few hours after injection.

No. 259.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasion on elbow. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery. *Remarks.* A mild case in spite of short period of incubation.

No. 260.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus(?). *Nature of injury,* cause not discovered. *Period of incubation,* unknown. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 13.5. *Make,* Tizzoni. *Other treatment,* urethan. *Result,* recovery.

No. 261.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of heel. *Period of incubation,* unknown. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 26.0. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Mouse inoculated with the splinter died of typical tetanus.

No. 262.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* laceration of perineum. *Period of incubation,*

seven days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 16.0. *Make,* Tizzoni. *Other treatment,* urethan, morphine, *Result,* death. *Remarks.* No tetanus bacilli found, and a mouse infected also proved negative; but author says there is no doubt regarding the diagnosis.

No. 263.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* version for impacted breech presentation. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 2.0. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* death. *Remarks.* Mouse inoculated with the secretions from the cervix died of tetanus.

No. 264.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* craniotomy. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 94.5 cubic centimetres. *Make,* Behring, and 4.5. *Make,* Tizzoni. *Other treatment,* urethan. *Result,* death. *Remarks.* Mice inoculated with the blood of this patient died of typical tetanus. Tetanus bacilli found post mortem in lochiæ.

No. 265.—*Name,* Krausz.[284] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* tamponade of uterus for post-partum hæmorrhage. *Period of incubation,* ten days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 157.5. *Make,* Behring, also 7.0. *Make,* Tizzoni, and 60 cubic centimetres. *Make,* Paltauf. *Other treatment,* not stated. *Result,* death. *Remarks.* Tetanus bacilli found.

No. 266.—*Name,* Haberling.[285] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of foot. *Period of incubation,* thirteen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 5.0. *Make,* Behring, also 50 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Author says, a very bad case, and recovery greatly due to the antitoxin combined with narcotics.

No. 267.—*Name,* Haberling.[285] *Year,* 1899. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* injury of eye and orbit, caused by kick of a horse. *Period of incubation,* six days. *Day of first injection,* eighth day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Case complicated by erysipelas.

No. 268.—*Name,* Leick.[286] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of palm. *Period of incubation,* unknown. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 10.0. *Make,* Behring. *Other treatment,* chloral and morphine. *Result,* death.

No. 269.—*Name,* Tavel.[287] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of finger. *Period of incubation,* twenty-three days. *Day of first injection,* fifth day. *Method of administration,* subcutaneous. *Amount,* ten doses. *Make,* Tavel. *Other treatment,* chloral. *Result,* recovery.

No. 270.—*Name,* Tavel.[287] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of hand. *Period of incubation,* thir-

teen days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 16 doses. *Make,* Tavel. *Other treatment,* not stated. *Result,* recovery.

No. 271.—*Name,* Tavel.[337] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of finger. *Period of incubation,* about six weeks. *Day of first injection,* thirteenth day. *Method of administration,* subcutaneous. *Amount,* 24 doses. *Make,* Tavel. *Other treatment,* not stated. *Result,* recovery. *Remarks.* A very bad case in spite of long period of incubation, followed by recovery, due entirely to the antitoxin.

No. 272.—*Name,* Tavel.[337] *Year,* 1899. *Diagnosis,* Tetanus cephalicus. *Nature of injury,* lacerated wound of forehead. *Period of incubation,* ten days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 10 doses. *Make,* Tavel. *Other treatment,* not stated. *Result,* recovery.

No. 273.—*Name,* Tavel.[337] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed wound of finger. *Period of incubation,* three days. *Day of first injection,* few hours. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Tavel. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Cured in one hour after injection. Author says that result was wonderful, but he also expresses some doubt as regards diagnosis.

No. 274.—*Name,* Tavel.[337] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* pistol-shot wound of hand. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 6 doses. *Make,* Tavel. *Other treatment,* not stated. *Result,* death.

No. 275.—*Name,* Tavel.[337] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of forearm. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* not stated. *Make,* Tavel. *Other treatment,* not stated. *Result,* death. *Remarks.* Antitoxin was used too late.

No. 276.—*Name,* Tavel.[337] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of scalp. *Period of incubation,* six days. *Day of first injection,* second day. *Method of administration,* subcutaneous and intravenous. *Amount,* 50 cubic centimetres. *Make,* Tavel. *Amount,* 100 cubic centimetres respectively. *Make,* Tavel. *Other treatment,* not stated. *Result,* death. *Remarks.* Mice inoculated with the pus died of tetanus.

No. 277.—*Name,* Alessandrini.[287] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of great toe. *Period of incubation,* eight days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 25 cubic centimetres. *Make,* Tizzoni. *Other treatment,* Baccelli, etc. *Result,* recovery. *Remarks.* Author says recovery was entirely due to the antitoxin.

No. 278.—*Name,* Bernhart.[288] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasion of skin. *Period of incubation,* one day. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 55 cubic centimetres. *Make,* Roux. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Original not obtainable.

No. 279.—*Name,* Müller.[289] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* splinter injury of thumb. *Period of incubation,* ten days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 62 cubic centimetres. *Make,* Behring. *Other treatment,* chloralamid, morphine. *Result,* death. *Remarks.* Tetanus bacilli found in the wound and splinter inoculations also gave a positive result.

No. 280.—*Name,* Müller.[289] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot by a knife. *Period of incubation,* unknown. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 155 cubic centimetres. *Make,* Behring. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* A very chronic case.

No. 281.—*Name,* Van Camp.[290] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot by a knife. *Period of incubation,* eleven days. *Day of first injection,* tenth day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* not stated. *Other treatment,* morphine, KBr, hyoscyamus. *Result,* recovery.

No. 282.—*Name,* Murray.[291] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot by a stone. *Period of incubation,* nine to ten days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 90 cubic centimetres. *Make,* not stated. *Other treatment,* chloral and bromidia. *Result,* recovery. *Remarks.* Author says he is compelled to assume that the serum had a great deal to do with the recovery.

No. 283.—*Name,* Willis.[292] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* abrasion over patella. *Period of incubation,* ten days. *Day of first injection,* first day. *Method of administration,* intravenous and subcutaneous. *Amount,* 200 cubic centimetres. *Make,* Institute Pasteur and British Institute of Preventive Medicine. *Other treatment,* chloral, morphine, hyoscyamus. *Result,* recovery. *Remarks.* Author says that he is not satisfied that the recovery was due solely to the antitoxin, though he would use it in every case.

No. 284.—*Name,* Willy Meyer.[293] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* pistol-shot wound. *Period of incubation,* seven days. *Day of first injection,* not stated. *Method of administration,* subcutaneous. *Amount,* 120 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromidia, Baccelli. *Result,* recovery.

No. 285.—*Name,* Barachini.[294] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot. *Period of incubation,* seventeen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 50 cubic centimetres. *Make,* Tizzoni. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Judging from the description, a very grave case followed by quick recovery and, according to author, due solely to the antitoxin.

No. 286.—*Name,* Abbe.[295] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* pistol-shot wound of thigh. *Period of incubation,* sixteen days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* 160 cubic centimetres. *Make,* New York Board

of Health. *Other treatment,* chloral, bromide, morphine. *Result,* death. *Remarks.* A case with a long period of incubation. Of the antitoxin, the author says that it seemed at first to have some control over the spasms, but failed afterwards to show appreciable value.

No. 287.—*Name,* Abbe.[295] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot caused by a nail. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 120 cubic centimetres. *Make,* New York Board of Health. *Other treatment,* chloral, bromide, morphine. *Result,* death. *Remarks.* Author says this case proves the inefficiency of the New York Board of Health serum, if used subcutaneously and in moderate quantity, in a grave case.

No. 288.—*Name,* Abbe.[295] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of finger. *Period of incubation,* five days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 20 cubic centimetres. *Make,* New York Board of Health. *Other treatment,* chloral, bromides. *Result,* death.

No. 289.—*Name,* Abbe.[295] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of palm. *Period of incubation,* eleven days. *Day of first injection,* fifteenth day. *Method of administration,* subcutaneous. *Amount,* exact amount not stated. *Make,* Parke, Davis & Co. *Other treatment,* chloral, bromides. *Result,* recovery. *Remarks.* According to author, a milder case, but well influenced by Parke, Davis & Co.'s antitoxin.

No. 290.—*Name,* Crone.[296] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of scalp. *Period of incubation,* twelve days. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 2 bottles. *Make,* Behring. *Other treatment,* opium. *Result,* recovery. *Remarks.* Author says a very bad case, followed by recovery, although the antitoxin was used quite late.

Analysis of the Preceding Cases.

Total number of cases treated by subcutaneous injections, 290, of which 173 recovered and 117 died, or a mortality of 40.33 per cent. All the observations agree that the period of incubation is of great importance in the prognosis. On tabulating these 290 cases, I find the following values:

Of 1 case with a period of incubation less than 1 day, 1 recovered and 0 died, 0 per cent.; of 3 cases with a period of incubation of 1 day, 2 recovered and 1 died, 33.33 per cent.; of 1 case with a period of incubation of 2 days, 1 recovered and 0 died, 0 per cent.; of 2 cases with a period of incubation of 3 days, 2 recovered and 0 died, 0 per cent.; of 11 cases with a period of incubation of 4 days, 6 recovered and 5 died, 45.45 per cent.; of 15 cases with a period of incubation of 5

days, 7 recovered and 8 died, 53.33 per cent.; of 21 cases with a period of incubation of 6 days, 7 recovered and 14 died, 66.66 per cent.; of 28 cases with a period of incubation of 7 days, 14 recovered and 14 died, 50.0 per cent.; of 34 cases with a period of incubation of 8 days, 13 recovered and 21 died, 61.76 per cent.; of 16 cases with a period of incubation of 9 days, 8 recovered and 8 died, 50.0 per cent.; of 15 cases with a period of incubation of 10 days, 10 recovered and 5 died, 33.33 per cent.; of 17 cases with a period of incubation of 11 days, 12 recovered and 5 died, 29.41 per cent.; of 11 cases with a period of incubation of 12 days, 9 recovered and 2 died, 18.18 per cent.; of 14 cases with a period of incubation of 13 days, 12 recovered and 2 died, 14.28 per cent.; of 15 cases with a period of incubation of 14 days, 13 recovered and 2 died, 13.33 per cent.; of 7 cases with a period of incubation of 15 days, 6 recovered and 1 died, 14.28 per cent.; of 2 cases with a period of incubation of 16 days, 1 recovered and 1 died, 50.0 per cent.; of 1 case with a period of incubation of 17 days, 1 recovered and 0 died, 0 per cent.; of 4 cases with a period of incubation of 18 days, 4 recovered and 0 died, 0 per cent.; of 3 cases with a period of incubation of 19 days, 2 recovered and 1 died, 33.33 per cent.; of 14 cases with a period of incubation of over 19 days, 12 recovered and 2 died, 14.28 per cent.; of 30 cases with unknown period of incubation, 19 recovered and 11 died, 36.66 per cent.; of 25 cases in which incubation period is not stated, 11 recovered and 14 died, 56.0 per cent.

On attempting to concentrate these statistics, according to the usually published statistics, we get following values:

Of 33 cases with a period of incubation of less than 5 days, 19 recovered and 14 died, 42.42 per cent.; of 114 cases with a period of incubation of 5-10 days, 52 recovered and 62 died, 54.38 per cent.; of 64 cases with a period of incubation of 10-15 days, 52 recovered and 12 died, 18.75 per cent.; of 24 cases with a period of incubation of over 15 days, 20 recovered and 4 died, 20 per cent.; of 55 cases with unknown or unreported period of incubation, 30 recovered and 25 died, 45.45 per cent.

Total number of cases treated by intracerebral injections 48, of which 23 recovered and 25 died, or a mortality percentage of 52.08.

REFERENCES TO CASES TREATED BY SUBCUTANEOUS OR INTRAVENOUS INJECTIONS.

[167] Blumenthal: Zeitschr. f. klin. Medicin, Vol. xxx, 1896.
[168] Austin: Boston Medical and Surgical Journal, September 17, 1896.
[169] Whitington: Boston Medical and Surgical Journal, January 16, 1896.
[170] Engelmann: Münchner med. Wochenschrift, No. 32, 1897.
[171] Teichmann: Deutsche med. Wochenschrift, Th. B., No. 5, 1897.
[172] Kortmann: Deutsche med. Wochenschrift, Th. B., No. 9, 1897.
[173] Jacob: Deutsche med. Wochenschrift, Th. B., No. 1, 1897.
[174] Höfling: Deutsche med. Wochenschrift, Th. B., No. 3, 1897.
[175] Merkel: Münchner med. Wochenschrift, p. 1366, No. 48, 1897.
[176] Hollis: British Medical Journal, September 11, 1897.
[177] Beamish: British Medical Journal, October 2, 1897.
[178] McWatt: British Medical Journal, November 27, 1897.
[179] Proudfoot: British Medical Journal, February 6, 1897.
[180] Carter: British Medical Journal, April 17, 1897.
[181] Blake: Lancet, October 30, 1897.
[182] Smart: Lancet, November 20, 1897.
[183] Smyth: Lancet, December 18, 1897.
[184] Turner: Lancet, February 6, 1897.
[185] Chapman: Lancet, April 24, 1897.
[186] Chalmers: Lancet, June 5, 1897.
[187] Blaker: Lancet, April 10, 1897.
[188] Marsack: Lancet, April 17, 1897.
[189] Goldsmith: British Medical Journal, August 21, 1897.
[190] McCausland: British Medical Journal, August 21, 1897.
[191] Plücker: Deutsche med. Wochenschrift, V. B., No. 8, 1897.
[192] Trapp: Centralbl. f. Chirurgie, Nos. 3 and 4, 1897.
[193] Suter: Korrespondenzbl. f. schweizer Aerzte, p. 521, 1897.
[194] Wendling: Wiener klin. Wochenschrift, No. 11, 1897.
[195] Rudis-Jicinsky, New York Medical Journal, November 13, 1897.
[196] Asam: Münchner med. Wochenschrift, No. 32, 1897.
[197] Weischer: Münchner med. Wochenschrift, No. 46, 1897.
[198] Coffin: Therapeutic Gaz., November, 1897.
[199] Foster: Therapeutic Gaz., November, 1897.
[200] Fauser: Pesther Mediz.-chirurg. Presse, No. 1, 1897.
[201] Réczey: Pesther Mediz.-chirurg. Presse, No. 15, 1897.
[202] Rubeska: Archiv f. Gynäkologie, Vol. liv. No. 1.
[203] Steiner: Wiener klin. Wochenschrift, No. 36, 1897.
[204] Bargelessi: Gazzetta degli ospedal. e dell. clin., p. 493, No. 46, 1897.
[205] Frassi: Gazzetta degli ospedal. e dell. clin., p. 898, No. 85, 1897.
[206] Archmard: New Orleans Medical and Surgical Journal, p. 385, Vol. xlix, No. 7.
[207] Rose: Deutsche Zeitschrift f. Chirurgie, Band xlvi, p. 583.

[208] Boinet: Bull. Gener. de Therapeutique, Tom. 133, p. 433, 1897.
[209] Lardy: Revue de Chirurgie, No. 5, 1896.
[210] Steer: British Medical Journal, February 15, 1896.
[211] Grayson: Pittsburg Medical Review and Therapeutic Gazette, February, 1896.
[212] Gouley: New York Medical Journal, August 21, 1897.
[213] Cavandoli: Gazzetta degli ospedal. e dell. clin., No. 73, 1897.
[214] Rabek: Therapeut. Wochenschrift, p. 226, 1897.
[215] Owens and Porter: Journal of the American Medical Association, November 13, 1897.
[216] Tauber: Wiener klin. Wochenschrift, No. 31, 1898.
[217] Reinhard: Münchner med. Wochenschrift, No. 9, 1898.
[218] Möller: Münchner med. Wochenschrift, No. 9, 1898.
[219] Erdheim: Wiener klin. Wochenschrift, No. 19, 1898.
[220] Krokiewitz: Wiener klin. Wochenschrift, No. 34, 1898.
[221] Bruno: Deutsche med. Wochenschrift, No. 14, 1898.
[222] Schubert: Münchner med. Wochenschrift, No. 8, 1898.
[223] Hale: British Medical Journal, July 9, 1898.
[224] Morgan: British Medical Journal, July 9, 1898.
[225] Barrow: British Medical Journal, September 10, 1898.
[226] Trevithick: British Medical Journal, October 29, 1898.
[227] Willett: British Medical Journal, January 1, 1898.
[228] Sime: Lancet, September 24, 1898.
[229] Stoneham: Lancet, November 19, 1898.
[230] Brooks: Lancet, January 8, 1898.
[231] Patteson: Lancet, January 8, 1898.
[232] Hy. Croly: Lancet, January 8, 1898.
[233] Hy. G. Croly: Lancet, January 8, 1898.
[234] Denham: Lancet, January 8, 1898.
[235] Myles: Lancet, January 8, 1898.
[236] McCausland: Lancet, January 8, 1898.
[237] Curnow: Lancet, April 30, 1898.
[238] Greenwood: Lancet, April 30, 1898.
[239] Mixter: Boston Medical and Surgical Journal, October 6, 1898.
[240] Lund: Boston Medical and Surgical Journal, August 18,1898.
[241] Homans: Boston Medical and Surgical Journal, June 2, 1898.
[242] Riese: Deutsche med. Wochenschrift, Th. B., No. 5, 1898.
[243] Beuthner: Deutsche med. Wochenschrift, Th. B., No. 10, 1898.
[244] Patteson: Dublin Journal of Medical Science, February, 1898.
[245] Patteson: Dublin Journal of Medical Science, November, 1898.
[246] Potechin: St. Petersburgh med. Wochenschrift, p. (63), 1898.
[247] Carbognin: Gazzetta degli ospedal. e dell. clin., p. 1380, No. 30, 1898.
[248] Heddaeus: Münchner med. Wochenschrift, Nos. 11, 12, and 13, 1898.
[249] Bousquet: Bull. et Mém. de la Soc. de Chirurg. de Paris, Vol. xxiv, 1898.
[250] Koehler: Münchner med. Wochenschrift, No. 45, 1898.
[251] Stintzing: Mittheil. aus d. Grenzgebiet. d. Med. und Chir., Band iii, Heft 3 und 4, 1898.
[252] Barth: Semaine Médicale, Vol. xiii, No. 14.

[253] Capelli: Gazzetta degli ospedal. e dell. clin., p. 813, No. 76, 1898.
[254] De Yoanna: Medical Record, July 29, 1899.
[255] H. Copley: British Medical Journal, February 11, 1899.
[256] Clark: British Medical Journal, January 7, 1899.
[257] Galletly: British Medical Journal, February 18, 1899.
[258] Marshall: Lancet, April 22, 1899.
[259] Berry: Lancet, April 29, 1899.
[260] Wace: Lancet, May 13, 1899.
[261] Taylor: Medical News, p. 42, July 8, 1899.
[262] Cane: British Medical Journal, October 14, 1899.
[263] Mackey: British Medical Journal, December 16, 1899.
[264] Mills: Lancet, December 30, 1899.
[265] Rice: Lancet, October 14, 1899.
[266] Fraser: Lancet, August 26, 1899.
[267] James: Medical Record, September 9, 1899.
[268] Adams: Philadelphia Medical Journal, December 30, 1899.
[269] Packard: Philadelphia Medical Journal, November 18, 1899.
[270] Wagoner: Philadelphia Medical Journal, November 4, 1899.
[271] Arneill: Medical News, April 22, 1899.
[272] Moeller: Münchner med. Wochenschrift, No. 9, 1899.
[273] Werner: Münchner med. Wochenschrift, No. 9, 1899.
[274] Hönn: Münchner med. Wochenschrift, No. 14, 1899.
[275] Wullenweber: Deutsche med. Wochenschrift, No. 37, 1899.
[276] Engelien: Deutsche med. Wochenschrift, No. 5, 1899.
[277] Kleine: Deutsche med. Wochenschrift, No. 2, 1899.
[278] Pitha: Centralbl. f. Gynäkologie, July 22, 1899.
[279] Gessner: Inaugural Dissertation, Halle, 1899.
[280] Slawyk: Deutsche med. Wochenschrift, V. B., No. 33, 1899.
[281] Czylharz: Wiener med. Wochenschrift, No. 25, 1899.
[282] Holsti: Zeitsch. f. klin. Medizin, Vol. xxxvii, Nos. 5 and 6, 1899.
[283] Thieme: Zeitschr. f. pract. Aerzte, No. 7, 1899.
[284] Krausz: Zeitschr. f. klin. Medizin, Vol. xxxvii, Nos. 3 and 4, 1899.
[285] Haberling: Beitr. zur klin. Chirurg., Vol. xxiv, No. 2, 1899.
[286] Leick: Zeitschr. f. pract. Aerzte, No. 19, 1899.
[287] Alessandrini: La Riforma medica, Vol. iii, 1899.
[288] Bernhart: Gazz. lekarska, Nos. 10 and 11, 1899.
[289] Müller: Münchner med. Wochenschrift, No. 10, 1900.
[290] Van Camp: Journal of the American Medical Association, February 13, 1900.
[291] Murray: British Medical Journal, March 3, 1900.
[292] Willis: Australasian Medical Gazette, January 20, 1900.
[293] Willy Meyer: ANNALS OF SURGERY, March, 1900.
[294] Barachina: Gazzetta degli ospedal. e dell. clin., No. 3, 1900.
[295] Abbe: ANNALS OF SURGERY, March, 1900.
[296] Crone: Deutsche med. Wochenschrift, No. 3, 1900.

(TO BE CONCLUDED.)

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 11, 1900.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

THE CLOSURE OF WOUNDS WITHOUT SUTURE.

DR. HOWARD LILIENTHAL showed five patients upon whom he had performed abdominal operations during the past six months, and had closed the wounds without suture. In three of these cases the operation had been done for hernia, and in two for appendicitis. In all of them there was a firm linear cicatrix at the site of the incision.

Dr. Lilienthal said he had resorted to this method of closing wounds for the first time about two years ago, and he was so well pleased with the result that he now employed it as a matter of routine. It should be used only when there is little or no tension on the skin, and in such cases it presents material advantages over the suturing method for the following reasons: Sutures will occasionally suppurate in spite of all precautions. Buried sutures suppurate much more rarely than skin sutures, because it is practically impossible to disinfect the deeper layers of the living human skin; so sutures perforating the skin are particularly liable to infection. When catgut is used and becomes infected, it swells and plugs the suture puncture so that there is retention. Silk, when infected, does not swell, but acts as a drain. Still, it may infect the deeper portions of the wound, especially if the suture completely perforates the skin, and, like any suppurating cutaneous suture, it may vitiate the entire result of the operation; for example, a radical operation for hernia.

Silkworm gut is stiff and makes the tissues conform to the suture-loop instead of the suture conforming to the tissues. There is consequently a dead space, which, filled with blood or serum, invites infection.

The speaker said that for a time he had tried fine silk sutures placed close to the edge of the wound and not completely perforating the skin. With these, even if suppuration occurs, the infection is not so apt to involve the subcutaneous structures. The method is troublesome, however, and takes much time. The subcuticular suture is also a desirable one, but it is tedious and requires considerable skill for its correct application.

Dr. Lilienthal said he had also tried leaving the skin open until granulation had begun, then drawing the wound together with zinc plaster. This gave good satisfaction; but he subsequently found that the plaster could be applied at once upon the completion of the operation, and that suturing the skin could be dispensed with. The plaster he employs is the India-rubber zinc plaster of Dieterich. When the operation is finished and all hæmorrhage is absolutely checked, small strips of this plaster, about a quarter of an inch wide, and either short or long, depending upon the location of the wound, are applied transversely. If the wound is in a bulging region, like the abdomen, pretty long strips should be placed across it, so as to get a good hold, and these can be reinforced by shorter strips. By this method, if the wound remains clean, an absolutely linear cicatrix is obtained. If slight infection should occur, there are no sutures to be removed, and, as a rule, the discharge finds its way out between the strips of plaster. In the partial closure of wounds, the method also works admirably.

Dr. Lilienthal said he was well aware that this method of treating wounds was an old one, but its general application in the way he had described was not old.

Dr. George E. Brewer said the method of wound closure described by Dr. Lilienthal was entirely new to him until he saw it applied at Mt. Sinai Hospital about a year ago; since then the speaker said he had employed the method in quite a large number of cases, both at Mt. Sinai and the City Hospital, with very satisfactory results, especially after operations for the radical cure of hernia. Dr. Brewer said that at the City Hospital, during the past three or four years, there was more or less infection of the operative wound in from 5 to 10 per cent. of cases, of which at least four-fifths were simple operations for hernia or varicose veins, a class of cases which one would naturally expect to heal very kindly. About a year ago, the speaker said, he adopted the

plan of leaving the hernial wound partly open for twenty-four hours, putting in some gauze and inserting provisional sutures. More recently, instead of the sutures, he had simply used zinc plaster and found the results very satisfactory. By the use of plaster, we avoid all constriction of the tissues which is produced by any form of suture; furthermore, the apertures between the strips of plaster furnish the necessary means of drainage until swelling and agglutination of the tissues have taken place.

DR. WILLIAM B. COLEY said that in the treatment of hernial wounds he did not think there was any special need for any other method than the use of the ordinary catgut suture, applied under strictly aseptic precautions. The speaker said that since he had adopted the plan of wearing gloves while operating, he had had only a single instance of suppuration in 150 operations for hernia. In the case where suppuration occurred, pure streptococcus infection was demonstrated, and it was found that the skin was the origin of the trouble. It was not due to the sutures.

Dr. Coley said that, if the zinc plaster could be applied more quickly than the sutures and give good results, he saw no reason why it should not be used.

DR. LILIENTHAL, in closing, said that sutures were more liable to cause infection than the knife because the former are left in the wound, and by first passing through the skin the deeper tissues are quite apt to become infected by it. Another advantage of the use of plaster is that it shortens the operation by several minutes. In amputation of the breast and long abdominal wounds, time is often an important element. The plaster can be applied very quickly, and when it is removed the cicatrix looks like a mere scratch.

RARE COMPLICATIONS AFTER OPERATIONS FOR APPENDICITIS.

DR. WILLY MEYER read a paper with the above title.

DR. A. B. JOHNSON said he had observed thrombosis of the femoral vein in several instances after operation for appendicitis, and he could offer no satisfactory explanation for its occurrence. In all of the cases, with one exception, the operation for appendicitis was done in the interval between the attacks; all the patients, with one exception, were females, and usually rather anæ-

mic. In none of the cases had there been any wound disturbance after the operation. They were cases in which the wound had been completely closed, and he had no grounds for believing that the thrombosis was due to septic infection. All the cases resulted favorably. Dr. Johnson said he was inclined to favor the mechanical theory of the occurrence of these obstructions in the veins, combined with a rather feeble circulation in the individual. In all of the cases, the thrombosis was on the left side. The speaker said he recently saw a perfectly aseptic operation upon a movable kidney followed by a thrombosis of both femoral veins.

Dr. Johnson said that the complication of intestinal obstruction by adhesions or bands after operation for appendicitis was well illustrated by the case which he had shown at the previous meeting of the Society; it also showed the difficulties which may attend the diagnosis of this condition in certain instances, as in that case the obstruction developed gradually, and was not absolute until fifteen days after the operation.

Dr. Johnson said that two years ago he had observed a boy who was operated on for a severe attack of suppurative appendicitis. In the same year that patient required two operations for the relief of intestinal obstruction, and a third attack, which occurred the following year, proved fatal.

Among other complications after operations for appendicitis, the speaker narrated the following case as an example: The patient was a young woman who was operated on last winter for a quite severe attack of appendicitis; there was gangrene of the appendix, but no evidences of peritonitis. She did well for ten days, and then developed pain in the region of the liver, with tenderness in the upper abdomen and a slight degree of icterus. It was rather difficult to make out this discoloration of the skin, as the patient had some negro blood in her. The tenderness became more pronounced, and shortly afterwards she developed chills, which recurred almost daily. There was also marked leucocytosis. Her appendicitis wound showed no signs of infection, but her condition gradually grew worse, and at the end of the third week the abdomen was again opened. Just below the transverse mesocolon a mass of lymph glands was discovered; it was as large as a small orange and contained an abscess full of stinking pus. The abscess was evacuated and the glands partially removed. The girl died of pyæmia. No autopsy was obtainable.

Another complication which Dr. Johnson has observed after operations for appendicitis is suppurative inflammation of the portal vein. The symptoms of this developed very slowly. There was jaundice and ascites, and a secondary operation revealed nothing but the presence of this bile-stained fluid in the abdominal cavity. The autopsy, made six weeks later, showed that the portal vein had become infected, and that the suppuration had extended to the liver. An abscess was found within the liver. These cases, the speaker said, were probably due to the dissemination of small foci of suppuration.

Dr. Brewer said the case of retroperitoneal lymphangitis cited by Dr. Johnson reminded him of one which had come under his observation. The patient was a man who was operated on for acute appendicitis in the West. He made a good recovery, although he was moderately septic for a few days after the operation. Some time after his discharge from the hospital he developed pain in the lower abdomen, which became more pronounced on walking. Subsequently, there was contraction of the psoas muscle, and his temperature was constantly above 100° F. These symptoms continued for a month or two, when the patient came under the observation of Dr. Brewer, who opened the abdomen and found an indurated mass, with dense adhesions, which extended upward behind the peritoneum and kidney. Further dissection showed that this mass communicated with a retroperitoneal abscess; this was evacuated, and the man had no further trouble.

Dr. Brewer said he had seen one case of thrombosis of the femoral vein after an operation upon a prostatic abscess, which was drained through the perineum. The symptoms of thrombosis developed slowly, without fever, and gradually subsided. About four weeks after the operation, after the patient was sitting up and apparently well, he suddenly developed a temperature of 104° F., with cough and other symptoms of pneumonia. Two or three weeks later, the leg, which had not been previously affected, began to swell, and, although the swelling never reached a marked degree, symptoms of sepsis rapidly developed and the man died of pyæmia. The autopsy showed a thrombosis of both of the common iliac veins. The septic process had evidently been carried from the prostate to the right internal iliac, then upward to

the bifurcation of the vena cava, and down on the opposite side. Streptococci were found in the thrombus.

DR. COLEY said he recalled one case of large, burrowing abscess connected with the appendix in which death occurred about ten days after the operation from embolism.

In regard to intestinal obstruction as a complication after operation for appendicitis, the speaker reported the case of a boy who had been operated on in Boston in April, 1896, for an attack of acute appendicitis, from which he made an uneventful recovery. In August of the same year he developed symptoms of acute intestinal obstruction, and upon opening the abdomen three and one-half feet of intestine were found to be strangulated, and had to be resected. There was no general peritonitis. As the result of this operation, a large fistulous opening was left, which was still open in November, 1899, when Dr. Coley first saw him. At this time the boy was greatly emaciated, and it was determined to make an attempt to close the fistula by further resection of the gut. The operation was done about the middle of November, 1899; an incision was made two inches to the left of the sinus, and after separating the adhesions, the gut was resected and its ends were approximated with a Murphy button. The wound was drained for about a week. The boy's health improved very rapidly, and he gained twenty-three pounds in weight during the next six weeks. The stools were carefully examined for seventy days after the operation, but the button was never found.

DR. JOHN B. WALKER referred to the case of a man, thirty-five years of age, who was operated on for appendicitis. There was primary union, and the patient was out of bed in less than three weeks. A few days later he developed a thrombosis of the femoral vein on the left side. The symptoms of this subsided in about a week. There were no evidences of sepsis in the wound.

DR. ARTHUR L. FISK said he had seen two cases of metastatic abscess in the region of the liver after operation for appendicitis. In one of the cases the operation was for gangrenous appendicitis, and subsequently the temperature, which had fallen to normal, steadily rose, and the patient developed a tenderness on the left side of the abdomen. An incision revealed an abscess in the region of the liver.

Dr. Fisk said that last summer he saw a case where an operation for appendicitis was followed by malignant degenera-

tion of a sinus which involved the gut. The growth, which was pronounced an endothelioma, was excised, together with a portion of the caput coli and of the small intestine, and an anastomosis was done with Murphy's button. The patient recovered.

Dr. B. F. Curtis said he recalled two cases of phlebitis of the femoral vein, both in young men, and both on the left side. One occurred after an operation for suppurative appendicitis; in the other case, he did not recollect the details of the operation. The complication in both instances took place in the second week after the operation. The symptoms consisted of a slight rise of temperature and considerable pain and tenderness over the vein; there was no marked thickening and no œdema. In both cases the operation had apparently left a clean wound, and no cause for the thrombosis could be ascertained.

ANEURISM OF THE AORTA AND SUBCLAVIAN.

Dr. George Woolsey presented a specimen obtained from a man, forty-six years old, who was admitted to Bellevue Hospital on November 12, 1899. His family history was negative. He was a moderate drinker and denied syphilis. His health had been good up to about one year ago, when he began to suffer from shortness of breath and a loss of his power of endurance. He complained of pain in the left shoulder and arm, but never had much pain about the heart. He also suffered from a short hacking cough, which, because of its peculiar sound, he called a "piccolo" cough. His general health was poor.

Examination of the heart disclosed a double murmur over the base, and a pulsating tumor at the suprasternal notch, over which a double bruit could be heard. The right radial pulse was stronger than the left, the latter being weak, compressible, and delayed. The pulse-rate was 84 to 112.

After a course of treatment in the medical wards of the hospital, which produced no improvement in the symptoms, the man was transferred to the surgical side, where he was operated upon on February 19, 1900. A trocar, which had been previously coated with a layer of hard rubber, so as to prevent the passage of electricity through the instrument to the tissues, was introduced into the tumor from the right side towards the left. Through this about six feet of fine silver wire were inserted, and a current of electricity, of twenty to thirty milliampères, was passed for

an hour without visible result, so that it was gradually increased up to seventy milliampères, and continued for quarter of an hour. Following this operation, it was reported that there was some diminution in the pulsation of the aneurism, but as the tumor continued to increase in size, the operation was repeated on March 7. At that operation about nine feet of wire, composed of silver containing seven and one-half per cent. of copper alloy, were introduced, and a current of electricity even stronger than before (as high as eighty and one hundred milliampères) was allowed to pass through it for about an hour. The man failed to improve, however, and died on March 21.

The autopsy disclosed the fact that there were two aneurisms,—one of the aorta, and a second, possibly a diverticulum of the first, which involved the subclavian. In a third sac, which communicated rather freely with the second, lay the inner end of the clavicle, completely eroded of periosteum; it also contained the eroded upper end of the sternum. The latter sac was filled with a clot formed around the coils of the silver wire, but a passage-way between this clot and the sac wall allowed the passage of a blood stream to an eroded spot on the surface whence the final hæmorrhage occurred. The second sac also contained several coils of the wire, each surrounded with a clot. The left subclavian artery was occluded near its origin. No other operation would probably have been any more successful than the method employed on account of the nature of the aneurism. A fairly firm clot was certainly produced around the coils of wire.

In reply to a question, Dr. Woolsey said that both the operations had been done under ether; and he did not think it would be possible to do it without a general anæsthetic. At the first operation, the positive pole was connected with the siver wire, and the negative was placed between the shoulder-blades. At the second operation, the negative was placed upon the abdomen, and the current was so strong that it blistered the skin.

EDITORIAL ARTICLE.

ON THE CO-OPERATION OF SURGEONS IN THE MAKING OF SURGICAL HISTORY.

THE times in which we live may be designated as the period of co-operation or mutual helpfulness. Upon that medical man who has found out a new truth, and who in the fulness of commercial selfishness retains his knowledge alone for his own use, medicine places its stigma. According to the unwritten laws of our profession, no doctor has a proprietorship in his own knowledge: it is the property of any brother physician for the asking. Three thousand years of medical literature bear witness to the growth and development of these principles.

In the works of the earliest physicians, we may observe the practices from which have become evolved the rules which guide us in the making of the literature of our day. Among the earliest methods of reporting cases was the presentation of the patient by himself. Strabo informs us that among the early Egyptians the sick exposed themselves in public places, in order that any one who had been similarly diseased, passing by, might see the sufferers, and give the benefit of his experience and tell how his cure had been wrought. In the "History of Babylon," Herodotus tells of this practice prevailing among the Babylonians. Many years later we find at Memphis that persons who had been cured of diseases went to the temples, and there had inscribed the symptoms of their diseases and the remedies whereby they had been restored to health, that these might later be consulted by the sick. Among the Æsclepiadæ records of cases were preserved and the remedies used in their cure. These records were handed

by father to son through many generations. In the temples of the priests of the school of Æsculapius were hung the votive tablets of those who had been healed. Here is one from Park's "History of Medicine:" "Julien vomited blood, and appeared lost beyond recovery. The oracle ordered him to take the pine-seeds from the altar, which had been three days mingled with honey: he did so, and was cured. Having solemnly thanked the god, he went away."

The great works of the old writers were devoted to a very considerable extent to what may be called the philosophy of medicine, and were lacking in simple unvarnished statements of fact. When we come to Paré, we find valuable reports of cases, but written rather in his own defence than for the instruction and guidance of his fellow-surgeons. Here is the report of a case from the pen of this great man: "M. le Prince begged me to go and see one of his gentlemen named M. de Magnane, now Chevalier of the Order of the King, and Lieutenant of His Majesty's Guards, who had his leg broken by a cannon-shot. I found him in bed, his leg bent and crooked, without any dressing on it, because a gentleman promised to cure him, having his name and his girdle, with certain words (the poor patient was weeping and crying out with pain, not sleeping day or night for four days past). Then I laughed at such cheating and false promises; and I reduced and dressed his leg so skilfully that he was without pain, and slept all night, and afterwards, thanks be to God, he was healed, and is still living now, in the King's service. The Prince de la Roche-sur-Yon sent me a cask of wine, bigger than a pipe of Anjou, to my lodging, and told me when it was drunk, he would send me another; that is how he treated me, most generously." This is another from the same great master of surgery: "M. de Pienne had been wounded, while on the breach, by a stone shot from a cannon, on the temple, with fracture and depression of the bone. They told me that so soon as he received the blow, he fell to the ground as dead, and cast forth blood by the mouth, nose, and

ears, with great vomiting, and was fourteen days without being able to speak or reason; also he had tremors of a spasmodic nature, and all his face was swelled and livid. He was trepanned at the side of the temporal muscle, over the frontal bone. I dressed him with other surgeons, and God healed him; and to-day he is still living, thank God."

Paré represents an example of a surgeon working alone and without the aid of the counsel of his peers; and as a result of this very condition we find him naturally falling into errors which it is difficult to reconcile with his fine judgment. The reporting of cases was conducted with little regard to classification or accessibility by the early masters of our art. An epoch in medical history-making in the English language began in 1766, in which year William Heberden recommended to the College of Physicians the first plan of the Medical Transactions. He recommended that members of the College report in writing cases of interest or importance which might come under their observation, "to illustrate the history or cure of diseases." His plan was soon adopted, and these observations were collected and published in volumes. In the preface of his "Commentaries on the History and Cure of Diseases" is found the principle of the system which guided him in making his notes of clinical observations. He says, "The notes from which the following observations were collected were taken in the chambers of the sick from themselves or from their attendants. . . . These notes were read over every month, and such facts as tended to throw any light upon the history of a distemper, or the effects of a remedy, were entered under the title of the distemper in another book, from which were extracted all the particulars here given relating to the nature and cure of diseases."

At the present time surgical literature is made and surgical procedures are regulated by those surgeons who make written records of their observations and work. Prior to the universal making of such records, discussions hinged largely upon matters

of judgment, personal prejudices, recollections, and the dictum of the masters. To-day we are approaching nearer to mathematical accuracy because of the vast amount of accumulated evidence which is being compiled and rendered accessible. The surgeon does not judge alone by his own little experience, but the experiences of the enlightened surgeons of the whole world are his. His own meagre observations might have given him other impressions, but the combined experience of a hundred surgeons has shown him which anæsthetic is accompanied with the least danger. Had it not been for the combining of vast numbers of observations in the treatment of hernia, surgeons would still be performing operations which have now been discarded as useless. The surgeon who has performed one operation with a mortality of 100 per cent. sees the mortality sink to 1 per cent. when he has before him the reports of ninety-nine additional operations without a death. And straightway the experience of others teaches him a lesson quite different from his own. The knowledge derived from the experience of one man has been of little value to him compared with what accumulated evidence has taught him of malignant tumors, with reference to recurrence; of abdominal sections, with reference to ventral hernia; of injuries of the brain, with reference to subsequent nervous phenomena; and of almost all of the other branches of surgery. If research and experiment and experience have added new knowledge, so have the dissemination and the application and the proving of this knowledge depended upon its introduction into literature. How many new ideas have been submitted by a sanguine originator only to be condemned before the tribunal of publication, time and trial. The co-operation of surgeons in presenting and reporting their cases and experiences has made possible the exalted position which surgery occupies to-day. So vital has this principle of co-operation become that scientific societies have multiplied with amazing rapidity, and a vast literature of incalculable value is accumulating. In the library of the Surgeon-General's office in our

country we have an institution which represents the highest plane of scientific advancement, and an index of which adds manifold to the value of every bit of new medical knowledge which may develop in any corner of the world. A mighty locomotive is a thing of circumscribed usefulness without a road-bed and a system of rails. In our surgical work there is a vast amount of valuable knowledge, inaccessible and unused because of defects in the channels of transmission.

The most valuable studies of cases come from hospitals, for here an abundance of material and opportunities for careful study make these institutions to lend themselves particularly to these ends. Much can be done to improve their histories and the indexing of their cases. The office of historian should take no minor place. Furthermore, a large number of hospital patients after operation find their way into other hospitals, often for the relief of some condition related to their first operation. Thus, hospitals are issuing reports of malignant tumors extirpated and the patient discharged cured, while the patient is being operated upon elsewhere for recurrence. Hernias are being reported cured, while in some other institution a secondary operation is being done or the patient is being fitted with a truss. While one surgeon is discoursing upon his improved method of closing the abdominal wound, another is operating upon his case for the cure of ventral hernia. Thus grave imperfections exist at the very source of our best information.

The writer would urge upon such institutions the adoption of a broader co-operation. He would have all hospitals supplied with a blank form, to be filled out and sent to the hospital in which the patient had previously been. This blank should be filled out by the historian at the bedside of the patient while he is taking the history, and sent to the office to be mailed to the other hospital from which the patient had formerly been discharged. This would apply particularly to cases which had been subjected to operation; but many other conditions, of

course, would merit such a report. A form which has been recommended for adoption in the Methodist Episcopal Hospital of New York, and which the author is pleased to say has been accepted, reads as follows:

To THE.....HOSPITAL.

The patient referred to below has come under our observation since leaving your hands, and you are hereby advised of the present status.

Name .....
Previous Address .....
Condition for which treatment was given in your hospital, according to patient's statement.....
Statement of dates concerning same:
Admitted .....
Operation .....
Discharged .....
Present name .....Age.....
Condition upon admission in this hospital bearing upon previous history .....
Treatment adopted or contemplated.....

This opportunity is also taken to request that you inform us whenever possible of the after-condition of patients whose histories show that they have once been under our care. This applies particularly to the following conditions: Malignant tumors, with reference to recurrence; abdominal sections, with reference to ventral hernia; operations upon the skull and brain, with reference to subsequent nervous phenomena; and all conditions of patients who have once been under our care, a knowledge of which will add to the value or completeness of our histories of the cases.

Hospitals might agree among themselves as to what they wish reported back to them. In the above form only four conditions are specified.

This seems to the writer to be entirely feasible and practicable. Each institution is placed upon its honor, and its internes begin their professional work with a lesson in medical ethics.

It would also be feasible for local surgical societies to organize a central bureau of information, its members to report, upon such a blank as the above, cases of a specified character, and to receive such information as comes in concerning such cases as have been in their hands. The labor would be slight, and the benefits accruing would not be inconsiderable. The writer has in certain cases, which have come under his notice, practised notifying the individual or institution, in whose care the patient had previously been, of the status presens. The writing of a letter was found to be tedious, but the filling in of a few words in a blank is simple and commended itself for general use.

JAMES P. WARBASSE.

THE SURGICAL TREATMENT OF PRIMARY RENAL TUBERCULOSIS, WITH A CONSIDERATION OF THE IMMEDIATE AND REMOTE RESULTS AFTER OPERATION.

By OTTO G. RAMSAY, M.D.,

OF BALTIMORE, MD.,

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THE treatment of primary renal tuberculosis has now become, fortunately for our patients, almost entirely surgical in character, and, from the results which have followed in the more recent cases, this form of treatment can be considered as not alone promising good hopes of complete immediate recovery from the operation, but, if a proper study of the case has been made and the proper indications followed, a final and lasting cure.

As renal tuberculosis is, however, still considered as occupying the vague and undefined border-line between medical and surgical diseases, a comparison of the medical and surgical forms of treatment should be made before attempting to describe the methods and results of surgical treatment alone.

Post-mortem records answer in the affirmative the question as to whether or not healed renal tuberculosis is ever seen, so that in the first place we must admit its possibility. Madelung, of Germany, speaks of healed renal tuberculosis, and describes caseous tubercular nodules surrounded by a mass of dense fibrous tissue, as is seen in lung tuberculosis. He also describes a condition in renal tuberculosis in which the renal pelvis is invaded by sclerotic fatty tissue, with closure of the ureter, and apparent cessation of active inflammation.

Tuffier, Lancereaux, and Le Dentu, in France, describe a like condition, and in the same class may be placed several cases which are described by Michel ("Des tuberculoses latentes du rein." Thèse pour le Doctorat, Paris, 1897) under the name of latent tuberculosis of the kidney. He cites nine cases, but only two of these can be used as examples of healed tuberculosis, both showed atrophy of the affected kidney, and in both cases the kidney was surrounded by a mass of sclerotic fat, as described by Madelung.

David Newman ("Tuberculous Disease of the Kidney: Its Etiology, Pathology, and Treatment," *Lancet,* February 24, 1900) also takes up the question of the healing of renal tuberculosis and describes a case illustrating this form of termination. He found the "right kidney much atrophied from the tuberculous disease; it weighed one ounce, was embedded in a mass of adipose tissue, and in its upper extremity was a small cavity with smooth walls, of the size of a hazel-nut, filled with pultaceous material. Several other small cavities existed containing caseous matter. The left kidney was enlarged by compensatory hypertrophy and weighed seven and one-half ounces." He attributes this tendency towards healing, which is occasionally met with either to a marked resistance of some individuals to the invasion of the tubercle bacillus, or to the introduction into the kidney of bacteria weak in virulence and few in number.

L. Bolton Bangs makes another addition to the number of healed cases in an article entitled "The Remote Results after Operation for Renal Tuberculosis," appearing in the ANNALS OF SURGERY, January, 1898. He describes here a case which he considers as possibly cured, or at least that the disease is in a state of abeyance, and that no new foci have developed. This case can be classed with the other cases of healed renal tuberculosis, however, only from the clinical stand-point, and the author takes the precaution to say he considers his patient as still menaced by the presence of the tubercle bacilli in the renal tissues.

Under what conditions this healing occurs can only be

answered theoretically, by citing either unusual resistance of tissues or weak virulence of bacteria; and though many attempts have been made to treat renal tuberculosis by general measures calculated to strengthen the tissue resistance, or, by the use of various medicinal agents, to lessen the virulence of the organisms, the success thus far has been but slight. Therefore, though we are sure that the healing of renal tuberculosis is possible, yet, as we do not know under what conditions it takes place, we are no farther advanced than before this fact was proved, and cannot say that any particular case is suitable or unsuitable for its trial. The following case, which I had the opportunity of seeing, will give the general experience of most surgeons.

The patient was a young woman of about twenty-one, who had suffered for some months with frequency of micturition, and had had a few attacks of pain in one region. Tubercle bacilli were demonstrated in the urine, and catheterization of the ureters proved that only one kidney was affected. Her general condition was so good that it was considered a favorable case to attempt general medical measures rather than an immediate resort to the knife, and she was fortunately in such a financial position that she could command anything necessary. In spite, however, of every care, she became steadily worse, and six months later it became necessary, on account of the local condition, to resort to operation; and, though she did quite well afterwards, the operation was difficult on account of the adhesions around the kidney, and the convalescence was tedious because of her weakened condition.

The character of the tubercular inflammation, from a pathological stand-point, also seems to contraindicate any form of medical treatment, as the semimalignant character of the growth is immediately recognized when we consider the peculiar chronic type of inflammation with its slow but steady development, the constant destruction of tissue, the tendency to invade surrounding organs, and, finally, the early and widespread bacterial metastases. For this reason we must not be influenced by the conservative indications which are our guide in the usual type of renal inflammation, but, because of this

clinical relationship to true malignant tumors, must follow the rule laid down for the treatment of malignant growths, and advise early and complete removal as offering the best means of immediate and lasting cure.

In studying the surgical treatment, I wish to consider, first, the operations having for their object the palliation or cure of renal tuberculosis, and then from a collection of cases I will attempt to formulate reliable statistics as to immediate and remote results, which may serve as a guide to us in work along this line. I have used for these statistics the cases collected by Facklam (*Arch. für klin. Chir.,* Band xlv, page 715), those collected by L. Bolton Bangs (ANNALS OF SURGERY, January, 1898), and to them are added a number which have appeared in the literature, as well as quite a number of unpublished cases which I owe to the courtesy of Dr. Willy Meyer, Dr. C. P. Noble, Dr. W. W. Keen, Dr. R. F. Weir, Dr. C. B. Penrose, Dr. George Tuttle, Dr. Baldy, Dr. C. Fenger, Dr. H. A. Kelly, and Dr. W. S. Halsted, of the Johns Hopkins Hospital.

In considering the various operations advised in the treatment of renal tuberculosis, we must divide them into those which have merely a palliative effect in view, and those which are performed with the hope of effecting a final cure. In the first class is placed nephrotomy, this being the only operation which is frankly done with the idea of palliation alone, all others being made with the hope, at least, of effecting a cure.

The curative operations are nephrotomy, resection of the diseased portion of the kidney and nephrectomy, or removal of the entire kidney, to which last must be added nephro-ureterectomy, a distinct advance over nephrectomy alone, the improvement consisting in the removal of the diseased ureter with the affected kidney.

Nephrotomy as a palliative measure is of great value, as in the first place it relieves acute symptoms which could not be reached in any other way; and in the second place, it does not preclude radical treatment later, when the patient has recovered sufficiently to stand more severe operative measures.

The class of cases in which nephrotomy is most valuable are those where the disease has caused marked constitutional changes. Thus, a patient, with rapid feeble pulse, hectic type of temperature, much emaciated, and suffering from constant pain, the presence of a large renal abscess, and great weakness, can be relieved immediately, though temporarily, by evacuating and draining this abscess cavity.

These are the operations of necessity, or emergency operations; and it is in this class of cases that most marked temporary improvement is often seen. It is in this class of cases, too, that sometimes the apparently miraculous cures are made, as many of these patients are undoubtedly brought to so low a condition by a mixed infection, pyogenic organisms gaining entrance to the diseased area, with a resulting acute septicæmia. When the abscess is opened the acute symptoms rapidly disappear, and if the tubercular infection has not extended to other organs, a secondary nephrectomy will give final cure.

Another class of cases in which nephrotomy is indicated comprises the patients who, besides the renal focus, have foci of tubercular disease in other portions of the body, usually the lung or the other kidney.

Included in this same class are also the patients in whom there is another fatal disease of some one or more of the important organs, either a chronic nephritis of the second kidney, amyloid changes in the second kidney, spleen, or other organs, or other fatal disease.

Tuberculosis of the bladder with primary renal tuberculosis is an exception to this general rule, as it is not at all uncommon to find bladder tuberculosis clearing up after the removal of the affected kidney. This fact has often been noted, and I have personally seen it occur in several instances.

Still another class in which nephrotomy may be indicated comprises the patients in whom it is questionable whether they have the necessary strength to withstand the shock of a severe surgical operation such as nephrectomy, but in whom immediate relief of the symptoms is necessary. In these it is better, perhaps, to be on the safe side and perform a primary nephrot-

omy, planning later a secondary nephrectomy under better conditions, and with a better hope of cure.

This last group of cases is possibly the most difficult group in which to decide what is to be done, as my statistics show that nephrotomy followed by secondary nephrectomy is a somewhat more dangerous operation than the primary nephrectomy. The figures which prove this, however, give rise to a fallacy, as my figures include all the cases of nephrotomy followed by nephrectomy; and naturally the patients must for some reason have been unable to stand the primary nephrectomy, and therefore must have been weaker than those where primary nephrectomy was done. For this reason it is hardly fair to compare directly the two forms of operation; and when the dangers of each are considered, the only added ones which can be theoretically applied to the nephrotomy followed by nephrectomy, and not to the primary nephrectomy, are the effects of a second anæsthetization with its action on the other kidney, the somewhat longer time that the first mentioned form of operation gives for the extension of the tubercular disease, and probably in some cases a more densely adherent kidney to remove.

Nephrotomy is a comparatively simple operation and requires but few precautions beforehand. In making the incision, the precaution is taken not to traverse the peritoneal cavity, and having this in mind the incision is made over the most fluctuant and prominent point of the tumor.

Large tumors in the renal region naturally raise before them the peritoneum; and the incision, for this reason, can be made further forward than is usually safe. The guide to the position of the peritoneal cavity may be stated in these cases to be the resonance of the ascending or descending colon; and if this is found lying to the inner side of the tumor the incision may be made between the anterior and posterior axillary lines below the costal margin, if this is desired, though it is better to make it as far back as possible, both for the ease of dressing the wound later and because of the probability of a secondary nephrectomy. The direction of the incision makes but little

difference, as a hernia is rare in this position; though, as previously mentioned, it is better to have it as far back as possible, as the resulting fistula is more easily managed here than if it be situated in the side.

The incision is carefully carried down through the muscles, separating them with the finger, or with the knife, and tying any small vessels which may bleed. On reaching the kidney an incision is made through its wall with the knife, or, if the wall be thin, it can be torn through with the finger. The primary incision through the kidney tissue may also be made with the Paquelin cautery, if hæmorrhage is feared. After the pus is evacuated the opening in the kidney is torn larger, and the fingers introduced into the cavity to discover and break up any secondary or subsidiary cavities. These may be detected, also, by making a bimanual examination with one hand on the anterior abdominal wall in front of the tumor, and the fingers of the other hand in the tumor. When it is certain that all of the secondary cavities have been opened, the general cavity is thoroughly irrigated and packed with washed-out iodoform gauze, taking care that the gauze is carried to the bottom of the sac.

The after-treatment of these cases is usually simple, the gauze is slowly removed, and the cavity is then irrigated daily and repacked loosely. After the lapse of several weeks or a month the external wound will have contracted down to a small sinus leading to the bottom of the former sac, and secreting a profuse purulent material, possibly mixed with urine, if the kidney is not completely destroyed by the tubercular inflammation.

It is important that the drainage tract should not be allowed to close, for, if this happens, a purulent collection is sure to follow, and a recurrence of the former symptoms results.

Nephrotomy as a curative measure has also been advised, and an occasional case is reported as cured by this method. It is always doubtful, however, whether the renal disease in these cases was really tuberculosis or not, and in most of the so-

called cures the patients have passed out of observation soon after the operation. I can find but four cases in which a cure lasting for any length of time has been reported, and even in these there is some question as to whether they were really tubercular or not. Therefore, though I have classed nephrotomy as a curative measure, it seems doubtful whether it really should appear under this head.

Resection of a Portion of the Kidney.—This operation appears at first sight to be the acme of conservative surgery, and, if the results were only reliable, we could not have a more satisfactory method of treatment. It is indicated, and a most valuable method of treatment in some inflammatory infections of the kidney, but in tuberculosis it is a dangerous method. In spite of the dangers, however, it is occasionally done, and Max Wolff ("Die Nierenresektion und Ihre Folgen," Berlin. 1900) has collected nine cases of renal tuberculosis treated by resection of the diseased portion, or by curetting away of the same, which operation he considers as similar to the resection, leaving behind in both operations from one-third to two-thirds of the kidney.

In his monograph he seems to consider it a good method of treatment in selected cases, and on the first glance the results would seem to be good.

On considering his cases, however, but two out of the nine gave entirely satisfactory later results,—one, reported by Israel (*Freie Vereinigung der Chir.,* Berlin, 1896-97), was well one year later, and the other reported by Morris (The Hunterian Lectures on the Surgery of the Kidney, *British Medical Journal,* March 26, 1898) was well two years later. Two other cases were reported as cured on leaving the hospital, and of the remaining, one was found to have tuberculosis of the other kidney, one was operated on at the same time for tuberculosis of the testicle, which would point to other foci of tuberculosis in the body, and three died; one of these, five hours after operation, and two at a later period, one from broncho-pneumonia, the other from general tuberculosis.

The chief danger is due to the peculiar insidious develop-

ment of the tubercles, which in the first stages are not visible to the naked eye; and for this reason it is always uncertain whether or not all of the diseased tissue is removed. Besides this, small foci of disease may be deeply hidden in the depths of tissue which on the surface appears normal.

I have seen several examples in which at first sight only a portion of the kidney appeared diseased, but which on careful pathological examination showed either discrete microscopical tubercles in the apparently healthy kidney, or in which there were small abscesses situated deeply in the renal substance, and not appearing until sections in various directions through the kidney had been made. These facts seem to me to be a direct contraindication for resection of the kidney in renal tuberculosis. König in a late article ("Die Chirurgische Behandlung der Nierentuberkulose," *Deut. med. Wochenschrift,* February 15, 1900) expresses the same view in regard to resection of the kidney for this disease, considering it a highly dangerous procedure.

The operation consists in exposing the kidney and bringing it out of the wound as is done in nephrectomy. The diseased portion is marked off from the healthy tissues and removed with the knife or cautery, cutting through tissue which appear to be normal. The raw surfaces are brought together by sutures and the wound drained or closed. In the resection it is well, if possible, to make a V-shaped incision through the kidney, that the raw surfaces may be more easily coapted. Hæmorrhage is usually not troublesome, and can be controlled by suture. The cautery is not usually advisable, as the separation of the eschar may be followed by hæmorrhage.

Nephrectomy or Excision of the Kidney.—This is our most valuable operation in dealing with primary renal tuberculosis, and may be done either as the primary operation or may follow a primary nephrectomy, as the curative measure, when the nephrotomy has failed to give relief.

Primary nephrectomy is indicated in all cases in which one kidney alone is diseased, though this must be qualified by stating that there must be no discoverable tubercular foci in

any other important organ, save the bladder or ureter of the same side. As another possible exception to this rule may be classed the cases in which a small tubercular area in one lung has been demonstrated, the patient being otherwise in good condition, as occasionallly such a patient under proper hygienic and climatic conditions will to all appearances regain complete health.

The indications for a secondary nephrectomy after nephrotomy are not so plain; the usual indication appears to be a persistent or troublesome fistula, which shows continued development of the tubercular disease. Another strong indication for secondary nephrectomy is change for the worse in the general condition; for example, the patient, after apparently improving for a time following the incision and drainage, begins to lose strength and flesh, or the temperature begins to vary, and in such cases nephrectomy is indicated.

Nephrectomy may be performed in several ways,—the operation may be extraperitoneal or transperitoneal, the pedicle may be ligated or clamped, or the kidney may be shelled out of its capsule, leaving the capsule in position. Besides these, nephro-ureterectomy, or removal of the ureter with the kidney, may be done, or the operation may be still more extensive, and a portion of the bladder be removed with the kidney and ureter. The indications for and against these modes of operation depend partly on the personal preference of the individual surgeon, though some general rules may be laid down as guides.

The chief objection to the transperitoneal form of nephrectomy is, that the peritoneal cavity is opened, with its attendant danger of peritonitis added to the shock of the kidney removal; and, though this is not a frequent cause of death, it has repeatedly occurred in transperitoneal nephrectomy. On the other hand, the transperitoneal operation gives somewhat more space for the necessary manipulations. The lumbar or extraperitoneal nephrectomy does away with the danger of peritonitis, though the peritoneum even in these cases is sometimes opened accidentally during the operation. The amount of room which is obtained in the lumbar nephrectomy is some-

what less than the transperitoneal method, and for this reason large tumors are removed with greater difficulty. The general rule may be laid down, however, that it is safer, if possible, to attack the kidney by the extraperitoneal method, and, if necessary, more room can be obtained by the resection of a rib, or by auxiliary incisions. This is especially true if a mixed infection is supposed to be present, as the most frequent cause of peritonitis seems to be a rupture of such an abscess, with the escape of the purulent material into the peritoneal cavity during operation.

The incision made depends, as does the choice of operation, greatly on the individual preference of the surgeon. In the extraperitoneal nephrectomy the incision giving most room is one beginning at the outer border of the quadratus lumborum muscle just beneath the twelfth rib, and extending from here obliquely downward and forward along the crest of the ilium. A method advised by Morris, which consists in separating the muscles with the finger instead of cutting through them as is usually done, may also be tried if the kidney be small. The skin incision for this last method is quite a long one, and after the skin, fat, and fascia are divided with a knife, it is laid aside, and with the fingers a hole is torn through the muscular layers, taking care that the tear is in the direction of the muscular fibres. In this way the muscle is not cut, and, even more important, one avoids cutting the cutaneous branches of the spinal nerve which give sensation to the skin over the flank and buttock.

The incision for the transperitoneal nephrectomy may follow closely the curve of the costal margin, may be made obliquely from the edge of the quadratus lumborum muscle, forward and downward to the anterior superior spine, or it may be made through the anterior abdominal wall in the middle line, or at the outer edge of the rectus muscle. If these incisions do not give space enough for the necessary manipulation, they can be enlarged by auxiliary incisions at right angles to the primary one.

When the kidney is reached, it is carefully separated from

the surrounding tissues, taking care in the separation that no auxiliary or abnormal branch of the renal artery is cut.

These abnormalities are quite frequent, and it is common to find a branch coming off directly from the aorta to the upper or lower pole of the kidney, or if not from the aorta, a like branch may be given off from the renal artery and enter the kidney in the same position. Special care must be taken in freeing the two poles, as at these points adhesions are most apt to be dense and firm. After the kidney is freed the next step is the treatment of the pedicle, and naturally the safest method is to isolate and tie separately all the renal vessels. This is difficult in many cases, however, as there is a mass of fat usually surrounding the renal pelvis and vessels which is apt to be dense and hard because of the inflammatory condition. In such cases the pedicle will have to be ligated either *en masse* or in several portions, which can be done by passing an aneurism needle through the centre of the pedicle, working it between the vessels, and tying in both directions.

For this class of cases, a heavy artery clamp, which is placed in position and left on the pedicle for from twenty-four to forty-eight hours, has been advised. Some surgeons have obtained good results in this way, never having had any trouble with the clamps. Several cases of severe hæmorrhage, however, after removal of the clamp, stamp this method as rather a dangerous one, and a ligature is certainly a more satisfactory means of treatment.

Nephro-ureterectomy.—After the removal of the kidney, the next question that arises is what shall be done with the diseased ureter. A French surgeon, Reynier (*La Semaine Médicale,* February 24, 1893, Vol. i, No. 8), first answered this question by removing a tuberculous ureter some months after the removal of a tubercular kidney, and since this time quite a number of somewhat similar operations have been done with complete success. Dr. H. A. Kelly reports in *The Johns Hopkins Bulletin* of February to March, 1896, three cases of nephro-ureterectomy for renal tuberculosis; and since that time (March, 1896) several like operations have been done at

the Johns Hopkins Hospital with equally good results. Only one of these cases was followed by a persistent fistula, and it was due in this case to a deeply buried silver-wire suture.

Nephro-ureterectomy may be performed either transperitoneally or extraperitoneally; though the extraperitoneal route is as convenient and much safer than the transperitoneal one. The incision is begun at the external border of the quadratus lumborum muscle just beneath the twelfth rib, and curves downward and forward along the crest of the ilium to a point above the anterior superior spine, then downward and parallel to Poupart's ligament.

We have evolved in doing this operation several points which are of considerable importance, and which lessen somewhat the danger. In the first place, instead of making the incision continuous throughout its whole length, the usual oblique incision in the renal region sufficiently large to allow a separation of the kidney, renal pelvis, and upper portion of the ureter is made, and the kidney carefully separated and the vessels ligated. Another incision is then made about eight centimetres in front of the lower point of the first, extending along the crest of the ilium, and after the muscles are cut through the peritoneum is loosened, pushing it inward towards the median line. Then by pulling on the kidney in the other incision the ureter can be distinctly felt as it tightens over the muscle. When the ureter is located, the kidney and upper portion of the ureter may be pushed under the bridge of muscle left, or the ureter may be tied in two places, divided between, and only the divided lower portion pulled under the bridge of tissue. After this is done, it is easy to follow the ureter in the iliac fossa to where it crosses the brim of pelvis and downward to its entrance into the bladder, pulling on it and freeing the tissues around it as one advances. The uterine artery will have to be tied where it crosses the ureter, but otherwise no important structure need be disturbed.

Several plans have been advised to get rid of the portion of the ureter left at the bladder, and the most satisfactory would seem to be a removal of the portion of the bladder

through which the ureter passes, closing the bladder wall by two layers of sutures. If this cannot be done, the portion of the ureter may be brought down and pulled through an opening in the vaginal vault, where it is fastened. Drainage is necessary after this extensive operation; and it is most satisfactory to place drains both from below, through the vaginal vault in the female, or through the lower angle of the wound in the male, and from above through the kidney wound, the rest of the incision being firmly closed by several layers of interrupted sutures.

The chief points in this form of nephro-ureterectomy are the bridge of muscle tissue left undisturbed strengthening the abdominal wall, the removal of the entire ureter, with possibly the adjacent portion of the bladder, and the extraperitoneal route of the operation.

The question as to what becomes of a tubercular ureter if it is not removed with the kidney is still somewhat doubtful. It is probable that the persistent fistula which follows in so many cases of nephrectomy for tuberculosis may be due to the ureter left *in situ*.

A. B. Johnson (ANNALS OF SURGERY, 1899, Vol. xxix, page 754) describes the later condition in a case in which the kidney was removed sometime previously for renal tuberculosis. In this case the ureter was found much thickened at the first operation, and a persistent fistula remained after it. At the later operation the ureter was found to have almost entirely disappeared, being represented by a thin fibrous cord, containing at intervals three or four beads about the size of buckshot, which on incision gave vent to a material resembling axle-grease, partly cheesy in character. F. Tilden Brown (ANNALS OF SURGERY, 1899, Vol. xxix, page 755) spoke of having seen a similar case in which he removed a tubercular kidney, leaving the ureter behind. The patient died some months later, and at the autopsy, the ureter, which at the time of operation was enlarged to about the size of the thumb, had diminished fully one-fourth in size, though tubercle bacilli were still present. From these cases, Brown

considers that non-functionating tissue, as the ureter must be after the kidney is removed, resists more strongly the growth of the tubercle bacilli, and that final cure may follow. Several other surgeons spoke of having seen like results in cases in which the ureter was not removed; and though these reports do not prove anything definite, still, they rather tend to show that in some cases, at least, a tubercular ureter left in the body is able to take care of itself, and will resist further extension of the tubercular inflammation, finally becoming a fibrous cord in which no definite tubercular structures can be found. This would account for the cases which, after having been troubled with a persistent fistula for several years, are finally entirely cured.

That this favorable result does not, however, always follow is evidenced by several cases reported by Dr. McCosh (ANNALS OF SURGERY, 1899, Vol. xxix, page 757). One of these was operated upon three years before, a tubercular kidney being removed. Two years later an abscess developed near the site of the ureter, which was opened and scraped, healing temporarily. Later, a second abscess appeared lower down, and McCosh expected to have to remove the diseased ureter later. In another case he removed, one year later, a tubercular ureter as thick as a man's thumb, filled with tuberculous granulating material, and in still another case, a persistent fistula remained behind, through which methylene blue could be injected into the bladder. Dr. H. A. Kelly has had a similar experience with a patient from whom he removed a tubercular kidney, and had later to remove the ureter for continued vesical and ureteral tuberculosis.

These cases show that we cannot always depend upon the non-functionating ureter taking care of itself, and prove that when possible ureterectomy in addition to the nephrectomy is necessary, as we can never be sure that the ureter will not give trouble later.

TABULATED RESULTS AFTER OPERATION.

I have collected 304 cases of renal tuberculosis in which some operative form of treatment has been followed, the opera-

tions comprising nephrotomy, nephrotomy followed by nephrectomy, resection of the diseased portion of the kidney, and primary nephrectomy, or, in fact, every form of surgical treatment advised for renal tuberculosis. From these the following statistics have been compiled.

I have in these statistics placed the deaths after operation in two divisions, those occurring within one month being considered the immediate deaths, while those occurring later than one month are considered as the remote results.

Nephrotomy not followed by any other operation was done in fifty-five cases. Among these, fifteen died within the first month after operation; twenty-two died at a later period, varying between two and one-half months and three years; eight were noted as improved at the time of reporting the case, and ten were noted as recovered. In six out of the ten it was extremely questionable whether the patient was really suffering from a renal tuberculosis; and it is probable, from the symptoms and condition, that the inflammation was rather a pyelonephritis or pyelitis from other causation. This leaves but four out of the fifty-five in which complete recovery could be claimed. Of these four, one had remained well for three years, another for three months; the third was noted as a recovery "per primam," with no note of the final result, and the fourth case was lost sight of soon after the operation.

The cases of death within one month were of interest. Out of the fifteen, two cases were reported in which the cause of death was not stated; this leaves but thirteen, among which two died of septicæmia, six of uræmia, the second kidney being involved in the tubercular process; two from peritonitis following the rupture of a perinephritic abscess; one from amyloid disease of the other kidney, and two from disseminated tuberculosis.

Among the twenty-two cases which died at a later period than one month the cause of death was not stated in nine, which leaves thirteen to be accounted for. Among these both kidneys were tubercular in six; one had amyloid disease of the

second kidney; two died of general miliary tuberculosis, and four of pulmonary tuberculosis.

Among the eight noted as improved, one suffered from cavities in the lungs; another from tubercular abscesses in other portions of the body; two had persistent fistulæ; another complained of pain and vesical tenesmus; in one the other kidney was involved in the tubercular disease, and in two no definite cause was given for classing them as improved. Thus, out of fifty-five nephrotomies not followed by other operation, we find but four in which recovery can be claimed, and in but one out of these four did the recovery certainly last for any length of time. These results seem to class nephrotomy almost entirely as a palliative rather than as a curative operation.

I have collected 191 cases of primary nephrectomy, of which 106 are noted as followed by complete cure, lasting from one month to twelve years; thirty-one were improved by the operation, thirty-seven died within one month after the operation, and seventeen died at a period later than one month. As cures, only those cases are classed which presented no later symptoms of bladder involvement or of disease in other portions of the body. The duration of the cure varied from a period of two months after operation to a period of twelve years; this last being the longest time that I could find, and is reported by König in his recent article on the surgical treatment of renal tuberculosis.

On examining these figures more closely, it is found that of the 106 cures the duration is not noted in twenty-six, leaving eighty in which the duration is definitely stated. Of these twenty-five remained cured over two years; twenty-one over a year, and thirty-three between one month and a year. Among the thirty-one cases classed as improved we find eight who were only suffering from a persistent fistula, which had lasted from one month to twenty-four months, the patient otherwise being well. It is probable that among these a certain number could later be classed as cured, for sometimes the fistula heals at a late period, due either to the slow fibrous change in the ureter, or, as occasionally happens, to the removal of a

ligature or suture deep in the wound. In one case, besides a persistent fistula, the patient had tuberculosis of the bladder which resisted any form of treatment. In seven cases symptoms were given which indicated probable tuberculosis of the second kidney,—though this could not be certainly determined,—and some of them had lived perfectly comfortable for four or five years after the operation, in one especially the only suspicious occurrence being an occasional attack of hæmaturia. Certain tuberculosis of the second kidney, which would undoubtedly be fatal sooner or later, was present in three patients; four suffered from tuberculosis of the lung, and three from persistent tuberculosis of the bladder.

In the 191 cases of primary nephrectomies there were fifty-four in which death was the result, thirty-seven dying within a period of one month and seventeen at a later period, varying between forty-five days and three and one-half years. Among the thirty-seven patients dying within one month, fourteen did not survive longer than forty-eight hours, the remaining twenty-three living from forty-eight hours to twenty-three days.

These thirty-seven, or nineteen of the whole number, may be considered as comprising the immediately fatal cases; and when it is remembered that these 191 nephrectomies for renal tuberculosis comprise practically all that have been performed, beginning with the earliest case, when the operative technique was much less advanced than at present, the percentage seems indeed a lower one than might be expected.

That this percentage can be made still lower in the future is proven by a study of the causes of death which follows.

TABLE I.

CAUSES OF DEATH WITHIN A PERIOD OF ONE MONTH.

Uræmia	9
Tuberculosis of other kidney	3
Amyloid degeneration of other kidney	2
Collapse or shock	5
Peritonitis	4
Septicæmia	3
Hæmorrhage	2

Exhaustion	2
Carbolic acid poisoning	1
Necrosis of gut	1
Ulceration of bladder (septicæmia)	1
Cause of death not stated	4
	37

It will be seen from the above table that nine cases are noted as dying from uræmia, that three more had tubercular disease of the second kidney, and that in two more there was amyloid degeneration of the second kidney; thus fourteen out of the thirty-seven died within one month from disease of the second kidney, and all most probably from uræmia. With our present means of determining the condition of the separate kidneys, death from tubercular or amyloid disease of the kidney left in the body should not happen, so that we may count out the last five, having nine where the cause of the uræmia was not stated. There are a few cases reported in which complete anuria, probably of reflex origin, have followed removal of one kidney when the remaining one appeared healthy, and this might have occurred with some of these. It is natural to suppose, however, that the uræmia in these cases also followed tubercular or amyloid changes in the second kidney, or at least chronic nephritis, any of which might be discovered by a careful study of the separated urines.

It is necessary, too, that we consider nephrectomy for renal tuberculosis in these cases from two points of view. Naturally, in the first place, nephrectomy is practically always done as a life-saving operation, and from this stand-point the fourteen cases were failures. In the second place, however, it must be realized that all of these fourteen patients were probably affected by fatal disease of the second kidney, and that the death was only hastened by the operation, and would have certainly followed, even if no operation had been done, in a short space of time, and therefore, though the operation was not successful in saving life, it must only be taken as hastening the certain death.

Collapse or shock was the cause of five deaths; and these

were probably the cases in which a nephrotomy, followed at a later period by nephrectomy, would be indicated, rather than the primary nephrectomy, as the patients were most probably in a much debilitated condition.

Peritonitis was the cause of death in four cases, and may be ascribed to faulty technique. The operations were transperitoneal, and in most of them rupture of the purulent sac probably occurred during the nephrectomy, with infection of the peritoneal cavity by forms of pyogenic organisms which are sometimes present as a mixed infection.

The extraperitoneal method of removing the kidney lessens to a great extent this danger, though even the extraperitoneal method does not prevent accidental wounding of the peritoneum and peritoneal infection.

Septicæmia cannot be avoided always; and when we consider the lowered resistance of the patient following the tubercular disease, the lessened power of eliminating toxins, as only one kidney is functionating, and, finally, the large wound into which various infectious organisms may be poured from rupture of the nephritic abscess, three does not seem a very large percentage of deaths from this cause.

Hæmorrhage can always be avoided by using sufficient care in securing the pedicle, taking the precaution that the pedicle is long enough to allow a good hold to the ligatures, and, finally, that all abnormal vessels are securely tied. In using the clamps to secure the pedicle, a hæmorrhage is always possible; and for this reason it hardly seems advisable, as the clamps may slip; it may cut through the tissues, or a firm clot may not have formed, and the pressure may force it out when the clamp is removed in twenty-four or forty-eight hours.

Exhaustion should probably be classed with collapse or shock, but as I found two with this cause of death, they were classed as such.

Carbolic acid poisoning, which probably caused death in one case, need not be considered as a cause of death now, as carbolic acid is so rarely used, and this case occurred in the days when carbolic acid was the chief antiseptic reliance.

The two other causes of death—necrosis of the gut and septicæmia from a deep ulceration of the bladder—could not be guarded against, and might happen at any time.

The study of the causes of death following operation are open to so many fallacies, and depend so greatly on the personal equation of the individual surgeon, that it is generally a difficult task to glean any very reliable statistics from them, and leaves the student with many important questions still unanswered. In the first place, it is easy to state that with the present means of diagnosis it is never necessary to remove one kidney before the condition of the second one has been determined, and thus fourteen deaths from uræmia after the nephrectomy might have been avoided.

This is a most optimistic statement, and only to be hoped for in the future utopia of perfect surgery, when all of our instruments of diagnosis are absolutely correct, when every ureter can be catheterized with certainty, and when our deductions from the obtained results are beyond criticism in every way. This perfection will not, unfortunately, be ours for many years to come, and for the present we must be thankful for the wonderful advances already made, which will certainly place the future death-rate from uræmia after nephrectomy at a much lower figure than fourteen out of thirty-seven deaths, or 38 per cent.

In criticising the other cases of death, several striking instances in which improvement might be made can be seen. Four deaths from peritonitis is a large percentage, and should be improved on; the chief point being the indication for the extraperitoneal method, if this be possible.

Hæmorrhage and septicæmia might also have been avoided, certainly in some cases, by care during the operation, avoidance of the clamp method for control of the vessels, and careful cleansing of the wound; and though shock and collapse are sometimes unavoidable, still, it would seem better judgment, in cases in which it might be expected, not to attempt immediately the nephrectomy, but relieve the immedi-

ate symptoms by incision and drainage, to be followed later by nephrectomy.

At any rate, from a careful study of the cases, I feel justified in prophesying better and better results, and a steady lowering of the death-rate as advances are made in diagnostic technique and operative ability.

A review of the cases of death at a later period develop also several interesting points.

TABLE II.

DEATHS AT A LATER PERIOD THAN ONE MONTH AFTER OPERATION.

Pulmonary tuberculosis	5
Tuberculosis of the second kidney	2
Tubercular peritonitis	1
Tubercular meningitis	1
Intestinal tuberculosis	1
Bladder and intestinal tuberculosis	1
General tuberculosis	1
Anuria from calculus, second kidney also tubercular	1
Pyelonephritis	1
Scarlet fever, kidney seat of acute nephritis, not tubercular	1
Acute peritonitis, probably suppuration around second kidney	1
Exhaustion	1

In the first place, the number of deaths, twelve out of seventeen, from tuberculosis in other parts of the body is striking, and points to a careless examination of the patient before the operation, for tubercular foci in other organs demonstrate the fact that an apparently primary tuberculosis is often secondary to a concealed focus in other organs, or that occasionally bacterial metastases take place very early in the course of the renal disease. Another point which the table illustrates most happily is the perfect ability of one kidney to carry on the body work, if it be healthy; for in searching the table but five deaths are noted as due to the kidney condition. Of these, two were due to tubercular disease of the second kidney, a third followed complete anuria from blocking of the ureteral orifice by a renal calculus, and in this one the kidney was also tubercular, one other died of pyelonephritis apparently not tubercular in character, and the fifth death fol-

lowed scarlet fever three years later, the kidney showing the lesions of acute nephritis but not tubercular, and, really, this last case should be classed among the cures.

A sixth death may also be attributed to the kidney, as one patient died of an acute peritonitis apparently following rupture into the peritoneal cavity of a perinephritic abscess.

Still another thing which seems important is the comparatively small number of deaths, seventeen out of 191, or about 8.5 per cent., at a later period than one month, showing that the prognosis for final cure is extremely good after the immediate results of the operation are over.

In my tables there are forty-nine cases of primary nephrotomy followed at a later period by nephrectomy; among these twenty-three are classed as cures; seven were either much improved or improved; one was not improved, and eighteen died within one month or at a later period. Among the twenty-three that are classed as cured the duration of cure was not stated in five, leaving eighteen among whom the period of cure extended from one month to seven years. As in primary nephrectomy, I class as cured only those cases in which no symptoms were complained of after the operation. Among the seven which were noted as improved, four suffered only from a lumbar fistula; and it is reasonable to suppose that one or more of these will finally be cured. One out of the seven improved cases had tuberculosis of the lungs, and another showed albumen in the urine, with the probability of the second kidney being tubercular. Out of the eighteen deaths eleven took place within one month, the time varying from two to twenty-eight days, with about the same causes that are seen following primary nephrectomy. Uræmia was noted in two cases, nephritis in one case, and tuberculosis of the other kidney in one case, so that four out of the eleven probably died of uræmia. Perforation of duodenum caused death in one case; in one case there was fatal hæmorrhage following the removal of the clamp on the renal pedicle; one case died of exhaustion following operation, and one case of general

miliary tuberculosis, leaving three cases in which the cause of death was not stated.

The late causes of death, also, were due, as in primary nephrectomy, chiefly, if not entirely, to tuberculosis of other organs, two dying of pulmonary tuberculosis, one of tuberculosis of the second kidney, and the others of miliary tuberculosis.

The results of the nine cases of resection of the kidney have already been noted, and I will only recapitulate them here.

Among the nine cases there were two recoveries enduring respectively one and two years; two others were reported as cures on leaving the hospital, though they were lost sight of at that time. Of the remaining five, one developed tuberculosis of the second kidney, one had had an operation for tuberculosis of the testicle, and three were dead, one dying five hours after the operation, and two at a later period, one from lung complications, the other from general miliary tuberculosis.

From the study of the individual cases, and from the statistical figures based on these, I feel justified in formulating the following conclusions:

(1) That renal tuberculosis may be classed as a semi-malignant form of inflammation, and that for this reason surgical treatment of some sort is always indicated.

(2) That this surgical treatment will have a palliative or a curative end in view depending on the condition of the patient and the duration and extent of the disease.

(3) That nephrotomy in renal tuberculosis is to be classed as a palliative operation; and that as a palliative operation for the immediate relief of dangerous symptoms, and as not precluding a later nephrectomy, nephrotomy with drainage of the abscess cavity is most valuable.

(4) That resection of the diseased part of the kidney is contraindicated in renal tuberculosis because of the danger of leaving a tubercular focus in the portion left in the body.

(5) That nephrectomy or nephro-ureterectomy is indicated in every suitable case, and in suitable cases should be followed by a lasting cure in 55.5 per cent. of the cases.

(6) That the indications against nephrectomy are tubercular or other disease of the second kidney, or tubercular foci in other organs.

(7) That tuberculosis of the bladder is not to be considered a contraindication to nephrectomy, as it will probably heal later.

(8) That a small tubercular focus in the lung, if the patient otherwise is in good condition, may sometimes not be considered a contraindication.

(9) That in doubtful cases, when it is questionable whether the patient can stand an immediate nephrectomy, it is better to do a nephrotomy, following it later by nephrectomy.

(10) That the clamp method of controlling the pedicle is contraindicated from the danger of hæmorrhage after the removal of the clamp.

(11) That it is safest to remove the ureter with the kidney, as a persistent fistula may give trouble if it be allowed to remain in the body.

(12) That a certain proportion of these fistulæ will finally disappear, either after the removal of a deep suture, or because of the slow disappearance of the tubercular disease in the ureter, which in these cases gradually changes into a fibrous cord.

(13) That we may expect a steadily increasing number of final cures as our means of diagnosis improve, and as our surgical technique is carried out more carefully and scientifically.

A STUDY OF ONE THOUSAND OPERATIONS FOR ACUTE INTESTINAL OBSTRUCTION AND GANGRENOUS HERNIA.[1]

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Statistical studies of the results of important operations must be sufficiently extensive and include only such cases as have been subjected to operation done under conditions closely resembling the practices of the present period. There are no statistics on intestinal obstruction that fulfil these indications, and this study represents the writer's endeavors to supply the deficiency.

The use of statistics is often dangerously misleading, and they are capable of such misconstruction that by many their value is greatly doubted. If we are to use statistics at all, their compilation should be conducted with care and discretion. Familiarity with literary research leads the writer to believe that he may ask for some consideration of his efforts, as this analysis has been carefully conducted and represents, perhaps, a maturer experience than is usually given to such work.

The material for this study is derived from publications of cases operated on between 1888-1898. The past decade has been marked by the evolution of many and important features in the technique of intestinal surgery. Many methods have been introduced, and while their sphere of usefulness—or lack of it—has in many instances been clearly defined, some of the most efficient innovations may still be said to be on trial.

In all questions relating to the surgery of the intestinal

[1] Read before the New York Surgical Society, May 9, 1900.

tract, the line must be sharply drawn between acute and chronic conditions. In these tables no cases have been admitted in which a new growth or extra-intestinal inflammatory process was a factor contributory or direct. Very few of the cases included present any doubt as to the category they belong in; but the acuteness of the manifestations has been the standard rather than the length of time.

No attempt has been made to include all cases in the literature. The standard set was to obtain a sufficient number (1000) occurring in the given period of time. With the exception of about seventy-five cases, kindly furnished by Dr. Boleslaw Lapowski from the Russian literature and by Dr. Eugene Caravia from the Italian, all the cases were read in detail by the writer. The greatest pains have been taken to obtain accurate estimation of the duration of obstruction prior to operation, this being with very few exceptions (for the most part herniæ) clearly indicated in every case.

The subject of gangrenous hernia is not usually treated under the same heading as intestinal obstruction. If, however, these observations have any particular value, it is chiefly in the comparison of the advantages possessed by the various methods of intestinal reunion and repair, and, in order to obtain so broad a comprehension of the subject as possible, it has seemed judicious to consider the two varieties of obstruction on the same basis. The cases of hernia are not cases of strangulated hernia, but of *gangrenous* hernia, demanding direct interference with the viscus. With the exception of a very few cases of minor procedures, such as suture and invagination of the intestinal wall, the treatment consisted in resection or making an artificial anus, and this series alone contains items of much practical importance and interest.

In attempting a study of conditions reported by observers of widely varying training, experience, and methods, care must be exercised to stick to facts, and not to rely unduly on data largely dependent on the personal equation. The most important and desirable information that we would wish from such a study of intestinal obstruction is on the line of diagnostic

aids; but such data cannot be furnished from statistical observations of such complex elements, and it has seemed wisest to confine the inquiry to safer if less valuable questions.

Classification of Cases.—Hernia, 354; intussusception, 187; bands, 186; volvulus, 121; Meckel's diverticulum, 42; gall-stones, 40; openings, 34; foreign bodies, 16; miscellaneous, 20. Total, 1000.

The classification is based on clinical manifestations, that is, on the conditions as they present themselves at the operation, and, for the purposes of simplicity, they have been ranged into quite general groups.

It is necessary to note that the high percentage of intussusception is, perhaps, somewhat artificial, as this variety of obstruction was the subject of a special study by the writer some years ago, when all the available cases were carefully searched for. The proportion of obstructions by volvulus seems too large, certainly for practice in New York City; but, on the other hand, the references to it in Russian and German literature are very frequent.

The term " bands" has been employed here quite broadly, and includes adhesions as well as kinks, twists, etc., due to adhesions. It has seemed wisest to preserve the identity of the Meckel's diverticulum, although, clinically, it is a " band." This classification, owing to the large number of cases collected, is probably as satisfactory an arrangement as can be devised, though it is conceded that any one system necessarily has drawbacks. Mr. Treves [32] says, in reference to the relative frequency of the various forms of obstruction, " Precise information upon this point is not very easy to obtain. Statistics based upon post-mortem records must obviously be incomplete, as only a proportion of the examples of intestinal obstruction are (*sic*) fatal. Hospital records deal for the most part with the severer forms of the trouble; although it must be acknowledged that such examples of intestinal obstruction as are not serious or severe are few in number. Tables based upon the published records of individual cases are the least suited of all for the present purpose. Such records are largely

concerned with instances of successful treatment on the one hand, and with pathological surprises and anatomical curiosities on the other."

Part I. Intestinal Obstruction.

(646 cases; died, 312; mortality, 47 per cent.[1])

General Considerations.—Age. As will be seen by the accompanying table (Table I), the first decade contains by far the greatest number of cases, or 28 per cent. Of children of one year or less the percentage is 14 per cent,—this being the period when the greatest number of cases of intussusception occur. For the remaining decades the relative percentages show no marked difference, ranging from 15 per cent., between twenty and thirty years, to 9 per cent. between sixty and seventy years. It must always be borne in mind that this study is based entirely on *acute* conditions, because, otherwise, we might think that the maturer periods should show a greater difference, owing to the formation of malignant stenoses. Certain ages have an individual predisposition to obstruction, *e.g.*, infancy and early life—intussusception; while gall-stones and volvulus chiefly affect the elderly. Foreign bodies occur chiefly in young children, one-half of the total recorded falling in the first decade.

The mortality of the various decades does not, on the whole, show marked variations. It ranges from 23 per cent. in the fourth decade to the fifth with 56 per cent. It is relatively low in the earliest and latest periods.

[1] Fractions are not employed in these computations.

TABLE I.

DIVISION OF CASES ACCORDING TO AGE.

	Under 1 Year.	1–10.	10–20.	20–30.	30–40.	40–50.	50–60.	60–70.	70–80.	80–90.	90–100.
Number of cases	81	73	55	87	70	73	58	50	21	4	1
Per cent., total number of cases	14	14	10	15	12	14	10	9	4	..	..
" males	70	73	67	76	65	47	38	56	65	..	..
" mortality	47	50	49	47	23	56	33	54	38	..	..
" bands	..	4	38	40	43	33	31	28	14	50	..
" intussusception	100	40	23	16	11	4	5	8	5	..	..
" volvulus	...	8	12	11	25	26	31	28	38	..	..
" Meckel's diverticulum	...	5	3	16	5	1	5	..	..	25	..
" openings	...	6	11	10	5	9	1	6	5	..	..
" gall-stone	...	..	..	..	1	8	13	26	33	25	..
" foreign bodies	...	18	2	2	1	4	1	2	5	..	..

TABLE II.

DIVISION OF CASES ACCORDING TO SEX.

	Males.	Females.	Mortality, Males.	Mortality, Females.
Total	472	410	53 per cent.	37 per cent.
Per cent. of obstruction cases	65	35	54 "	33 "
" of hernia cases	34	66	28 "	40 "
" of intussusception	72	28	45 "	56 "
" of bands	58	42	40 "	30 "
" of volvulus	64	36	65 "	39 "
" of Meckel's diverticulum	78	22	65 "	33 "
" of openings	52	48	63 "	35 "
" of gall-stones	24	66	33 "	53 "
" of foreign bodies	43	57	.....	.....

Sex.—Table II. The sex (including here the herniæ) was recorded in 882 cases,—472 males, 410 females. There is an interesting disparity in the statistics of intestinal obstruction (males, 65 per cent.) and of the hernia cases (males, 34 per cent.). Why the masculine element is so marked in the intestinal obstruction series is not at all obvious. It would seem as if inflammatory conditions of the female pelvic organs should give rise to a certain number of adhesions

capable of provoking obstruction. One element determining the larger masculine proportion is the ratio of intussusception, approximating 5 : 2. Why more male children should have intussusception is not obvious. The writer has once before suggested a tight phimosis as a possible etiological factor from the straining at urination it may provoke.

The reasons for the greater frequency of hernia cases among women will be referred to again. Other pronounced disparities are found in the frequency of Meckel's diverticulum, —male, 78 per cent.; female, 22 per cent. The division of the sexes on gall-stones is quite in accordance with ordinary clinical observations,—males, 34 per cent.; females, 66 per cent.

Mortality of the Two Sexes.—Of the total (hernia and obstruction), one is immediately impressed by the lower female mortality, 37 per cent., as against male, 53 per cent. An analysis of the two groups yields some explanation. In the obstruction cases, the female mortality sinks still lower, 33 per cent.; while the male is 54 per cent. When we compare the conditions in hernia, we find a mortality of males, 28 per cent.; females, 40 per cent. This latter proportion can be explained by the greater frequency of femoral hernia among women, the damage being in this variety usually greater, and presenting greater technical obstacles in treatment.

The writer has no similar explanation to offer for the more favorable results of operations for intestinal obstruction in the female sex. Certain elements are commonly accepted as factors determining a greater tolerance to disease and operations in the female sex,—better and more regular habits, much less poisoning by alcohol, tobacco, and venereal diseases, greater tolerance to loss of blood and more rapid restoration of lost blood, and greater amenability to treatment.

Mortality.—Tables III to VI show the mortality. According to Table III, the variety of obstruction; Table IV, the duration of obstruction; Table V, in resection and primary enterorrhaphy; Table VI, in artificial anus.

Further comments on these results will be found in the appropriate portions of the text.

TABLE III.

MORTALITY OF THE DIFFERENT VARIETIES OF OBSTRUCTION.

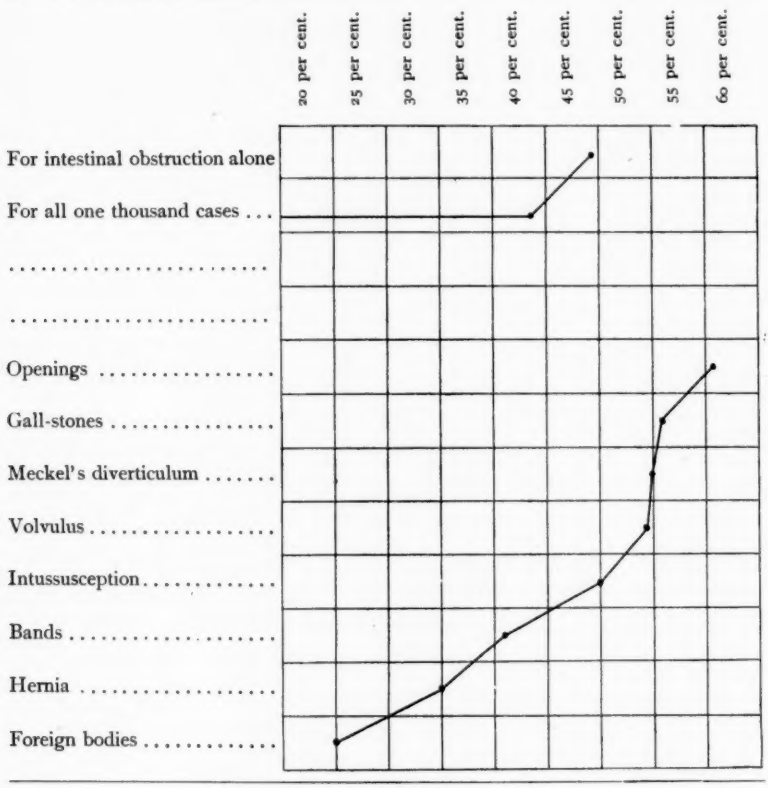


TABLE IV.

Results by Days.

The figures on the left hand of each column represent cures; those on the right, in italic type, deaths.

Days	1		2		3		4		5		6		7		8		9		10		11		12		13		14		3 weeks.		4 weeks.		Not stated.	
Bands	3	*2*	12	*4*	19	*5*	23	*11*	11	*11*	6	*11*	7	*4*	5	*8*	5	*4*	6	*1*	1	*2*	2	*2*	3	*1*	1	*1*	1	*6*	0	*2*	5	*1*
Intussusception	23	*12*	22	*12*	13	*20*	5	*11*	4	*12*	1	*3*	4	*5*	4	*3*	0	*0*	0	*3*	1	*0*	1	*1*	0	*0*	0	*1*	4	*1*	3	*0*	8	*10*
Volvulus	3	*3*	8	*6*	7	*10*	9	*7*	8	*8*	3	*7*	4	*3*	2	*7*	1	*0*	2	*3*	1	*0*	0	*2*	0	*1*	1	*1*	1	*1*	0	*0*	4	*3*
Meckel's diverticulum	1	*0*	2	*2*	2	*2*	2	*0*	4	*4*	0	*3*	1	*3*	0	*2*	1	*1*	3	*2*	0	*0*	0	*0*	0	*0*	0	*0*	0	*0*	0	*0*	0	*1*
Gall-stones	1	*1*	1	*1*	2	*3*	3	*2*	4	*3*	3	*1*	0	*5*	1	*0*	0	*1*	0	*1*	1	*0*	0	*0*	0	*0*	1	*0*	1	*0*	0	*0*	1	*4*
Openings	1	*0*	0	*3*	5	*3*	3	*0*	1	*2*	1	*5*	1	*0*	0	*2*	0	*0*	0	*2*	0	*0*	0	*0*	0	*0*	0	*0*	1	*1*	0	*2*	0	*1*
Foreign bodies	0	*0*	1	*0*	1	*1*	2	*1*	3	*1*	0	*1*	0	*0*	1	*0*	0	*0*	3	*0*	0	*0*	0	*0*	0	*0*	0	*0*	1	*0*	0	*0*	0	*0*
Miscellaneous	1	*0*	3	*1*	0	*1*	1	*0*	1	*1*	2	*1*	0	*0*	1	*0*	0	*0*	1	*0*	0	*0*	1	*0*	0	*0*	1	*1*	0	*0*	0	*0*	0	*3*
Hernia	12	*0*	45	*14*	45	*23*	30	*17*	24	*10*	12	*13*	7	*2*	14	*10*	1	*5*	6	*4*	2	*1*	2	*0*	0	*1*	1	*1*	2	*2*	0	*0*	30	*11*
Total	45	*18*	94	*43*	94	*68*	78	*55*	60	*58*	28	*45*	24	*22*	27	*32*	8	*16*	20	*16*	6	*3*	6	*5*	3	*4*	5	*4*	11	*10*	3	*4*	48	*34*
Grand total mortality, per cent.	29		31		42		42		49		60		49		54		67		44															
Mortality for intestinal obstruction alone, per cent	35		38		47		44		56		63		54		63		61		47															

TABLE V.

RESULTS OF RESECTION AND PRIMARY ENTERORRHAPHY IN INTESTINAL OBSTRUCTION.

	Total.	Died.	Mortality, per cent.
Intussusception	32	26	81
Bands	17	8	47
Volvulus	16	13	81
Meckel's diverticulum	5	4	80
Gall-stones	2	2	100
Openings	2	2	100
Foreign bodies	..	..	..
Miscellaneous	..	..	..
	74	55	74

The frequency with which resection and enterorrhaphy could be or had to be performed in the various forms of obstruction is interesting as showing but slight fluctuations.

Intussusception, resection performed in 17 per cent. of cases.

Volvulus, resection performed in 13 per cent of cases.

Meckel's diverticulum, resection performed in 12 per cent. of cases.

Openings, resection performed in 11 per cent. of cases.

Bands, resection performed in 9 per cent. of cases.

Gall-stones, resection performed in 5 per cent of cases.

TABLE VI.

RESULTS OF ARTIFICIAL ANUS IN INTESTINAL OBSTRUCTION.

VARIETY OF OBSTRUCTION.	WITH RESECTION.			WITHOUT RESECTION.			ALL CASES.			Percentage of Cases requiring an Artificial Anus.
	Cases.	Died.	Mortality.	Cases.	Died.	Mortality.	Cases.	Died.	Mortality.	
Intussusception	5	5	..	19	14	..	24	19	79	13
Bands	4	4	..	18	17	..	22	21	95	12
Volvulus	5	4	..	15	12	..	20	16	80	16
Meckel's diverticulum	1	1	..	3	2	..	4	3	75	9
Gall-stones	..	..	..	..	..	..	..	..	..	..
Openings	1	1	..	4	4	..	5	5	100	26
Foreign bodies	..	..	..	9	2	..	9	2	22	56
Miscellaneous	..	..	..	5	3	..	5	3	60	25
Total	16	15	94	73	54	74	89	69	77	12

TABLE VII.

INTUSSUSCEPTION, ONE HUNDRED AND EIGHTY-SEVEN CASES; MORTALITY AND CONDITION BY DAYS.

DAYS.	Died.	Cured.	Total.	Mortality, per cent.	Reduction.	Artificial Anus.	Resection.	Various.	Per cent. Reducible.
1	13	22	35	37	33	.....	2 6 per cent.	..	94
2	14	22	36	39	30	3 8 per cent.	3 8 "	..	83
3	20	13	33	61	20	4 12 "	9 27 "	1	61
4	10	5	15	67	6	3 20 "	5 33 "	..	40
5	11	4	15	73	7	5 33 "	2 13 "	2	47
6	3	1	4	75	2	.....	1 25 "	..	50
7	5	4	9	..	5	1 per cent.	3 33 "	..	..
8	3	4	7	..	4	2 "	1 "	..	..
10	3	..	3	..	..	2 "	1 "	..	..
11	..	1	1	..	1	.....	.....	..	..
12	1	1	2	..	1	1 per cent.	.....	..	..
14	1	..	1	..	1	.....	.....	..	..
3d week	1	4	5	..	3	2 per cent.	.....	1	..
4th week	..	3	3	..	1	.....	1 per cent.	1	..
Not stated	10	8	18	..	12	1 per cent.	4 "	5	..
Total	95	92	187	51	126	24 per cent.	32 per cent.		

ANALYSIS OF THE VARIOUS FORMS OF INTESTINAL OBSTRUCTION.

Age.	Cases.	Died.	Mortality, per cent.
Intussusception	187	94	50
Infants, 1 year or under	81	38	42
Children, 1 to 10 years	49	24	49
All others	50	27	54

Males, 72 per cent.; females, 28 per cent.

SITE OF THE INVAGINATION.

	Died.	Cured.	Mortality, per cent,
Enteric	23	15	60
Ileocæcal	50	46	52
Ileocolic	14	70	67
Colon	14	14	50

CONDITION OF THE INVAGINATION.

	Cases.	Died.	Mortality. per cent
Reducible	126	45	36
Irreducible	14	9	64
Gangrenous	23	22	95
Irreducible[1] or gangrenous	24	18	75

[1] Data insufficient to classify these cases any more accurately.

PROCEDURES EMPLOYED.

	Cases.	Died.	Mortality, per cent.
Reduced	126	46	36
Resection	32	26	81
Artificial anus	5	5	..
Resection and artificial anus	19	14	79
Various	5	4	80
Total	187	95	51

The writer's views of the secret of success in operating for intussusception have been recently expressed as follows:[16]

"I would lay particular emphasis on the fact that these cases are all acute, because the conditions of a chronic intussusception differ greatly from the acute, as regards indications for treatment and the results of such treatment. These acute cases are of three grades; that is, in addition to the ordinary term of acute, the condition may also be expressed as hyperacute or subacute, according to the intensity of the symptoms.

"In operating for intussusception, we find three degrees of change in the intussusceptum, each one varying very distinctly, in symptoms, in morbid anatomy, in the indications for treatment, and the results from the condition *per se*, and from the operative procedures in order. That is, we find on operating, that the intussusception is either reducible, irreducible, or gangrenous. And whether we find one or the other of these conditions *depends almost entirely on the duration of obstruction*. This fact I must emphasize, that in early interventions we get a reducible intussusception with a good prognosis; in *delayed* intervention, a more serious state of affairs, with bad prognosis *per se*, and requiring operations attended with greater shock and risk to life. Combined forms may exist, —that is, an intussusception may be reducible,—and yet be in a condition of gangrene or on the verge of becoming so. The irreducible intussusception may be entirely innocuous, except with regard to its mechanical impediment, or it may also be plainly gangrenous or it may present doubtful elements in regard to existing or threatened gangrene. It is, of course, obvious that the distinction between the several varieties must be clearly appreciated.

"The main feature of expected success in relieving intussusception depends: First, on the intussusceptum being found in a reducible condition and free from septic changes, and, second, that such a favorable condition can ordinarily only be met by a very early interference, that is, the prognosis depends absolutely on the promptness of relief. Under such circumstances, other things being equal, in competent hands, a comparatively good result is to be expected. But so soon as we encounter the second degree of severity,—the irreducible intussusception,—speaking in the strictest sense as of a purely mechanical phenomenon entirely free from septic conditions, the mortality is at once more than doubled. When we encounter the third variety, gangrene of the intussusceptum, we are confronted with a state so severe as to be almost beyond the hope of relief by human methods. For we are dealing with a profound toxæmia, which, if not checked, is necessarily fatal, and so affects the resisting power of the patient that even a trivial interference cannot be borne. And yet, in order to entertain the slightest hope of saving the patient, the operative measures undertaken must be drastic. A double indication exists,—the relief of the obstruction and the relief or elimination of the gangrenous element. To accomplish the one, without as thoroughly handling the other, is futile and absolutely bad judgment. To make an artificial anus in gangrene of the gut may relieve the obstruction, but brings no betterment of the prognosis, which still remains absolutely hopeless. Free extirpation of the intestine is called for, an operation which, in these desperate cases, is practically always fatal.

"The results of operations for these various degrees of intussusception bear out the above statements with remarkable accuracy. The mortality of reduction alone is only 36 per cent. In thirty-four cases in which an artificial anus was established the mortality was 83 per cent., and of thirty-two resections the mortality was 81 per cent. Only one case of resection of gangrenous intestine was saved. These results are perhaps most clearly defined when we study the conditions attending operations on any given day. (See Table VII.) For instance,

on the first day there were thirty-five operations and thirteen deaths, a mortality of 37 per cent. Even on the first day the bowel may be found so damaged that reduction alone is insufficient, as there were two resections performed, and a study in detail of the histories gives the impression that more such operations should have been performed. The percentage of reducible cases was 94 per cent.

"On the second day there were thirty-six operations with fourteen deaths, a mortality of 39 per cent. On this day six operations other than reduction were found necessary, namely, artificial anus, three; resection, three, bringing down the percentage of reduction to 83 per cent., while the mortality rate is on the increase. On the third day, of thirty-three cases, twenty died, a mortality of 61 per cent.

"These tabulations afford most striking proof of the disastrous consequences of delay. For now (third day) only twenty cases could be reduced (61 per cent.), and it was necessary to perform an operation for artificial anus four times and to do resection nine times. Here we strike a level between the percentage of reducible cases and the percentage of mortality. On the fourth day, of fifteen cases, ten died, a mortality of 67 per cent. The chief reason for this increased mortality is at once apparent, for on this day only six cases (40 per cent.) were reducible, the others requiring an artificial anus or resection. There is no need of any further elaboration to demonstrate the rightfulness of the plea that in order to obtain success operations must be performed early enough to find the intussusception reducible,—that good results depend entirely on reducibility.

"The fifth and sixth days show respectively a mortality of 73 per cent. and 75 per cent."

It is hardly feasible to go into any prolonged consideration of the treatment of intussusception by enemata (of fluids). That this method is a valuable aid and should be the first choice under certain conditions, the writer firmly believes. He, however, is inclined to the belief, on the principle of "the greatest good to the greatest number," that it is almost a mis-

fortune that there should be such a means of relief, as, owing to its ill-judged use, it costs many lives by delay and illusions as to its effects. His views on the subject have not changed since 1897.[2]

When the abdomen is opened, if the intestine presents no evidence of impaired vitality, the intussusception may be reduced chiefly by working the sheath back rather than pulling on its neck.

If the intussusception is irreducible, but presents no septic changes, an atypical resection may be performed, that is, exsection of the inner layer, by making a longitudinal incision below the neck, after having secured the point of junction between the two layers by a row of sutures at the neck, amputation of the inner layer just below the neck, suturing the cut edges, extraction of the amputated portion either through the original incision or from below, if accessible. If gangrenous, the whole intussusception must be formally resected, and the ends may either be united on the general principles of intestinal repair, or, if the patient's condition forbids further manipulation, and the portion of the intestine is not too near the stomach, they may be preserved as an artificial anus, repair being completed, as is most expedient.

The indications for establishing an artificial anus are extremely limited in intussusception, the operation being absolutely contraindicated with a gangrenous condition of the gut, as it only relieves the obstruction and not the sepsis, which, if unchecked, will as inevitably kill the patient as the element of obstruction. It is therefore only of occasional use in irreducible intussusception; and here it must generally be inferior in value to the atypical resection, especiallly as, in this variety, the patient's condition will more often allow of the time necessary for this comparatively simple operation.

Bands.

One hundred and eighty-six cases; died, 76; mortality, 41 per cent. Per cent. males, 58. Site of obstruction, small intestine, 81; large intestine, 6.

Procedures employed: Removal of obstructing cause, 127; mortality, 26 per cent.

Resection, 17; mortality, 52 per cent.

Resection and artificial anus, 4; mortality, 100 per cent.

Artificial anus, 18; mortality, 94 per cent.

Various, 4; mortality, 50 per cent.

It is worthy of note that there is a record of obstruction by more than one band in thirty-three cases, and the proportion is probably much greater. This failure to find or to search for more than one cause of obstruction accounts for some of the particularly bad results of operations for obstruction by bands; in no less than twenty-four out of the seventy-six deaths, recovery could not possibly have taken place owing to the inefficient or insufficient mode of operating, *e.g.*, a second obstruction, or several more obstructions besides the one definitely relieved, was found, post mortem, nine times. The obstructing cause was *first* found at the autopsy five times. There was failure in six cases to realize the damaged condition, although the obstruction was found attended with gangrene of the gut. In no less than four cases an artificial anus was made *below* the site of obstruction. These results are all obtained from post-mortem reports; when it is remembered that for most of the cases such complete information was unobtainable, it is fair to presume that there was a number of additional preventable deaths,—that many diagnoses of peritonitis, exhaustion, etc., really mean that the operation was neither sufficiently thorough as regards search for the obstruction, nor sufficiently radical in its treatment. For it must be ever reiterated that operations for intestinal obstruction have a twofold purpose,—relief of the obstruction and relief of the septic changes brought about by the obstruction, and that relief of the one without similar treatment of the other is absolutely useless.

The Nature of the Bands.—The most frequent cause appears to be dependent on inflammatory remains of appendical trouble, and from the female pelvic organs. Omental and epiploic adhesions were also frequent. Two of the operations

were for the adhesion of laparotomies performed three months and two years previously. While the subject for simplicity's sake is treated under the heading of bands, it must be borne in mind that many of these are in the form of diffuse velamentous adhesions, causing obstruction by kinking and knotting of the intestines, as well as by direct diminution of the caliber of the intestine and strangulation of its blood supply.

The study of this particular variety of obstruction shows again that the making of an artificial anus is usually a hit or miss procedure; that in order to obtain success it must be attended with certain fortunate conditions, whose existence the operator is generally unable to foresee or ascertain. Eighteen cases with one recovery is certainly a striking commentary of the unreliability of this treatment. The one recovery is an example of a piece of good luck rather than of a logically planned operation.[31] A man with fæcal vomiting, operation on the third day, the abdomen was opened, the presence of adhesions made out, but death seeming imminent, the operation was abandoned. The next day the wound was reopened, and an artificial anus was made in the small intestine. This opening was closed some hours later by suture; these gave way the next day, and a fæcal fistula developed; but the next day there was a fæcal movement per rectum. The fistula closed spontaneously in six weeks.

The resections yielded better results, eight successes of seventeen operations. The time when the operation was performed is undoubtedly a factor; the successes averaging three and four-tenths days of obstruction, the fatalities, eight and five-tenths. One resection on the second day was successful, although 135 centimetres were resected.

Of the various methods of resection, it may be noted that there was one success with Maunsell's method. Four unfinished resections, that is, exsection of the damaged gut, but leaving the ends as an artificial anus, repair to be made at a later and more propitious moment, were all fatal. The operation is, however, an eminently judicious one, and the results,

if discouraging, prove that the operators foresaw the inutility of completing the operation.

The Murphy button had three successes and two fatalities. One resection by end-to-end suture terminated fatally by the giving way of the sutures on the sixth day. In another resection, the autopsy showed areas of gangrene at the site of anastomosis and elsewhere.

There were four instances of side-tracking or entero-anastomosis. One ileocolic with Abbe's rings, death by shock; another with Senn's plates successful. One by sutures performed on the eighth day died of shock at the close of operation; in the remaining case a perforation of the bowel, exclusion of the loop by making an anastomosis above and below, was successful. For certain types of obstruction unattended with any damage to the vitality of the intestine, this operation, in the presence of very extensive and firm adhesions, is probably the ideal; but it must not be performed on doubtful cases, except with extraperitoneal isolation of the suspicious portion of gut by Hahn's method, until the fate of the intestine is determined.

Volvulus.

One hundred and twenty-one cases; died, 66; mortality, 54 per cent.; males, 67; females, 40.

Site.—Sigmoid, 58; died, 27; mortality, 46 per cent. Colon, 15; died, 7; mortality, 50 per cent.; average, 47 per cent. Small, 36; died, 25; mortality, 70 per cent.

Procedures employed: Untwisting, 79; died, 31; mortality, 29 per cent.

Resection, 16; died, 13; mortality, 81 per cent.

Resection and artificial anus, 5; died, 4; mortality, 80 per cent.

Artificial anus, 15; died, 12; mortality, 80 per cent.

The average age was forty-five.

Four of these operations were second operations for the same condition. Two by Roux were operated on six years previously. Eliot [3] reports a case of Foote's of a boy who was

operated on three times for this condition. There were also two deaths after operation from recurrence of the volvulus; the condition being verified by autopsy. There is no reason given the peculiar conditions predisposing to volvulus, atony, long mesentery, etc., why such recurrences should not occur quite frequently. Many operators have practised and recommended prophylactic measures; and a note relative to "anchoring" is found in eleven cases, either by fixing the affected loop to the abdominal wall, by taking a reef in the mesentery, or by a procedure, which Villar [20] claims as original, called "transverse colopexy." Obaliński in 1891 resected forty-seven centimetres of colon to avoid recurrence; in another case, fifty-six centimetres of sigmoid; both cases are classed as fatal, although one of them occurred four weeks after operation of pneumonia.

This form of obstruction when attended with damage to the gut gives rise to some of the most extensive lesions, as can be readily appreciated from the mechanics of the obstruction. Of thirteen resections, in which the length of gut exsected is noted, the average was 124 centimetres,—the longest being 365 centimetres cæcum and ileum; another, 250 centimetres ileum, both fatal.

The importance of the duration of the obstruction on the prognosis is shared in this variety of obstruction by the relative degree of obstruction depending on the degree of completeness of the twist. There may, however, be complete obstruction, with only a slight degree of torsion due to the bending produced by the weight of the descending mass, with little or no disturbance of the integrity of the gut. The degree of torsion is usually not clearly described in the published cases; it is also not always clearly appreciable clinically.

The distention is often so enormous, especially when the sigmoid is involved, that on opening the abdomen, it becomes absolutely imperative to evacuate the distended coil before further manifestations are attempted. This was done twenty-seven times. Even after successful reduction, it is the author's firm belief that provision must be made for the immediate

evacuation of the bowel, either by passing the rectal tube while the abdomen is still open, as was done successfully in several cases, or by incision of the gut. To allow the intestine to remain in a condition of paralysis from over-distention, and absorption of the putrid contents to continue, is to fail to realize the urgency of the situation. Great care should be exercised in closing this incision; and it is, perhaps, wisest to anchor it temporarily in the wound, lest extravasation should take place from post-operative paralytic distention.

The results of artificial anus are not much more encouraging than in other conditions,—three successes out of fifteen cases. In two instances the opening was so placed as to give no relief; in one it was made in the jejunum, and in the other there was extravasation backward into the abdomen. Most of the cases in which an autopsy was performed showed gangrene of the bowel and the obvious inefficiency of this form of treatment.

The volvulus was first found at the post-mortem in four cases.

Of the details of resection there is little to add to what has previously been alluded to, and no one method was marked by any particular success. It is in such operations that exsection of the ileocæcal coil is frequently necessary. The best method seems to consist in closure of the colon by suture and lateral implantation of the small intestine. This procedure has also been advantageously employed by Eiselsberg [7] in an extensive resection of the small intestine, with only a few centimetres remaining at its distal end.

The diagnosis of the condition before operation was probably made with greater frequency than in other forms of obstruction, with the exception of intussusception. It is usually easy to recognize the condition, especially when the large intestine, especially the sigmoid, is involved. The distention, though often extreme, is not uniform, and the coils involved may often be marked out quite accurately. There is usually less vomiting, sometimes none, and usually occurring late in the chain of symptoms. The history usually records a sudden

onset, also the fact that it is generally seen in middle or advanced life; with such data a diagnosis can frequently be made.

In this condition, when the small intestine is involved, the mortality is high, 70 per cent., as contrasted with 46 per cent. of the large intestine. This difference may be partially accounted for by its greater physiological importance, the greater acuteness and manifestations of shock. It is also probable that the mobility of this portion of the bowel allows of a greater tightness of the twist, and, in addition, the vitality of the intestinal walls is probably less.

There is only one record of successful resection of the small intestine for volvulus, 127 centimetres on the second day of obstruction (Riedel [28]).

Meckel's Diverticulum.

Forty-two cases; died, 23; mortality, 62 per cent. Males, 31; females, 8.

Procedures necessary: Division or excision of diverticulum, 30; died, 17; mortality, 57 per cent.

Resection, 5; died, 4; mortality, 80 per cent.

Resection and artificial anus, 1; died, 1.

Artificial anus, 3; died, 2; mortality, 67 per cent.

In one case an entero-anastomosis was made, the gangrenous gut being treated extraperitoneally: a very good procedure. The result, however, was fatal. In two cases the operation was not completed, the cause being found post-mortem.

The part of the bowel involved by the constriction was in all cases the small intestine, usually the lower end of the ileum.

The point of attachment is generally only vaguely alluded to; it seems to have been in the order of frequency to the abdominal wall, the umbilicus, and the mesentery.

Its point of origin varied from fourteen to thirty-six inches above the ileocæcal valve; for the most part at about twenty-four inches.

It may be noted that the subjects were usually young adults, and that the male sex is much more frequently so

affected. It is not evident why the mortality should be so high, as the damage to the intestine is not more frequent than in other varieties.

Oderfeld [12] has suggested that the presence of some congenital malformation, such as club-foot, harelip, cleft palate, webbed fingers, etc., should lead one to think of the possibility of another malformation, such as a Meckel's diverticulum, as a cause for obstruction.

In the only successful case [4] of artificial anus, the cause was only found at a second operation, the closure of the artificial anus having produced a recurrence of symptoms. There were several other instructive instances of failure to find the cause of obstruction; failure to divide the other end of the diverticulum still causing obstruction; [5] untwisting of what passed for a volvulus, the diverticulum being found post-mortem.[21]

Gall-Stone.

Forty cases; died, 21; mortality, 57 per cent. Males, 9; females, 27.

Age.—The youngest, thirty-five; only seven cases under fifty, and eight aged seventy or more.

Site.—The obstruction was only once found below the ileocæcal valve; once the stone was impacted in the valve. In twenty-one cases the history distinctly states the site of its arrest as the ileum, twice in the jejunum, and once at the junction of the jejunum and ileum.

There was a clear history of the passage of gall-stones, or of definite symptoms pointing to the presence of stones in eighteen cases; in five cases it is distinctly stated that there never had been anything to lead to suspicion of cholelithiasis.

In one instance the impacted stone could be felt through the abdominal wall.

The largest stone [11] weighed three and one-half ounces; the patient made a good recovery. Other large stones weighed respectively, two and one-quarter, two, one and one-quarter ounces, and one ounce, and the lightest, 170 grains.

Procedures necessary: Two resections were performed,

both fatal. In two cases the suture of the incision was perforated (post-operative paralysis), both fatal; though in one good judgment was exercised in treating the loop extraperitoneally.[33] In two instances the stone was simply pushed through into the small intestine. When incising the gut for extraction of the stone, it is wisest not to make the incision directly over it, as the intestinal wall may be injured by the pressure at that point and endanger the integrity of the suture.

Less damage to the bowel is produced by this form of obstruction than from constriction from without. The condition is easily discoverable at operation, especially if the nature of the obstruction is suspected beforehand, as can well be surmised in an elderly female with a previous history of jaundice or other symptoms of gall-stones. The symptoms are often quite mild, the obstruction being sometimes only partial for a certain period. The operative measures required are simple, and do not usually take much time. The patients, however, are generally unfavorable subjects for operation, owing to age and attendant complications.

It is interesting to note that no operator succumbed to the temptation of making an artificial anus.

Openings (and Diaphragmatic Hernia).

Thirty-four cases; died, 21; mortality, 62 per cent. Males, 21; females, 10.

Nature of opening. The diversity of language used to report these cases prevents a very satisfactory classification. Reduced to simple language there were, Fossa duodenojejunalis, 2; sigmoid fossa, 2; foramen Winslow, 2; mesenteric opening, 10; ileo-appendicular fossa, 1; "undetermined pocket," 1; pocket formed by vesico-umbilical urachus, 1; pocket from ligation of hernial sac, 2; sacculation in abdominal wall, 1; retrocæcal pouch, 1; "retroperitoneal" pouch, 1; fossa hypogastrica dextra, 1; opening between broad ligament and sacrum, 1; anterior vesical fossa, 1; properitoneal pouch at internal ring, 1.

In four of these cases the obstruction was first found post-mortem, viz.,—

(1) In the sigmoid pouch.

(2) In the sacculation of the abdominal wall, resection, and artificial anus of ends which were found to be two feet *below* the obstruction.

(3) In an opening between the sacrum and broad ligament, removal of a band apparently holding the bowel in the pelvis.

(4) In mesenteric opening, removal of a twisted gangrenous Meckel's diverticulum, artificial anus was made twice with fatal results, as might well be expected. Resection with artificial anus of ends, one case, fatal; two resections, one of four feet of bowel, both fatal; one of them in consequence of imperfect technique.[19]

The intestine prolapsed into these openings was in all but two cases the small intestine. The cæcum was once partially prolapsed into the foramen of Winslow; once both small and large were found in an "intraperitoneal" opening through the mesentery. The opening was closed by suture five times, —ileo-appendicular fossa, 1; mesenteric opening, 3; properitoneal pouch at internal ring, 1.

Diaphragmatic Hernia.

Six cases, all fatal. Males, 5; females, 1.

Case I.[25]—Boy, eight years old; operation on sixth day of obstruction. Hernia of cæcum and colon so far as the splenic flexure; reduction by dilatation of opening; died in twelve hours; bowels moved before death.

Case II.[10]—Man, twenty-nine years old; left pleural effusion and symptoms of intestinal obstruction. Diagnosis of diaphragmatic hernia made beforehand. Operation, resection of rib, opening of pleura; sudden death. Post-mortem, opening eight centimetres in diameter in the left half of diaphragm, through which was prolapsed greater part of stomach. Death due to pneumothorax; better to have sought access to it by the abdomen.

Case III.[20]—Man, twenty-one years old; operation on sixth day of obstruction. Laparotomy, hernia of splenic flexure through diaphragm; extraction; death.

CASE IV.[2]—Male, forty years old; laparotomy for acute obstruction. Nothing found, nothing done. Post-mortem, hernia of the stomach, splenic flexure, and omentum through hole in the diaphragm.

CASE V.[23]—Woman, twenty-five years old; obstruction of six days' duration; marked uniform abdominal distention; resonant on percussion everywhere except for dulness in the flanks. The abdominal wall and the diaphragm, notwithstanding the tremendous tympanitis, still retain some respiratory movement, however, of the "superior costal type." Artificial anus made on the cæcum, marked temporary relief. Fæcal empyema; died in seventeen days. Post-mortem, diaphragmatic hernia of descending colon and sigmoid 110 centimetres, with perforation of the intestine into the pleura. Commenting on this case, the authors add, "The orifice was situated above the spleen, the usual situation of acquired herniæ; of 133 cases, Boursier found that in over 100 cases this orifice occupied the left half of the diaphragm centre and was entirely independent of the normal outlets for the œsophagus and aorta. The presence or absence of a sac could not be made out in this case."

CASE VI.[30]—Man, thirty-three years old; obstruction, sixteen days. Laparotomy, nothing discovered; artificial anus made in the cæcum; died the next day. Post-mortem, hernia of the splenic flexure through the diaphragm.

It will be noted that the portions of the alimentary tract which prolapsed in all these cases were those in direct anatomical proximity to the diaphragm; although they involved very remote portions as regards the continuity of the alimentary tract, that is, either the stomach or large intestine, but never the small intestine.

The chief questions of interest are the diagnosis of the condition both before and after the abdomen is opened, and the best and safest operative route. If a routine physical examination of the patient were always made, it is probable that the diagnosis would occasionally be made, and more frequently its possibility would be suggested. When the abdomen is opened and evisceration is performed without finding an obstruction, the possibility of a hernia of the stomach should certainly occur to the operator.

Some operators have recommended the abdominal route, others the transpleural route. The ante-operative diagnosis will be so seldom made, that we must presuppose the abdominal route will be chosen. The advisability of the transpleural route will then only arise if the hernia cannot be easily reduced from below; it will probably not be a matter of choice, as the pleura must be invaded if access from below is insufficient. To talk of opening the pleura from choice, the writer thinks, is futile, as the pneumothorax is a very grave complication.

The subject is an interesting one and deserves consideration, which cannot be given here. The reader is referred to the authors already quoted and the references contained in Mr. Treves's work.[32]

Foreign Bodies.

Sixteen cases; died, 4; mortality, 25 per cent. Age ranged from six to seventy-nine; half of the number being in children of ten or under.

Site of Obstruction.—Colon, 1; transverse colon, 2; ileo-cæcal valve, 2; lower ileum, 3; small intestine, 1.

Procedures employed: Artificial anus, 9; 2 died.

Extraction and suture of incision, 6; 2 died.

Pushing of obstruction (worms) through into lower bowel, 1.

One artificial anus closed spontaneously, others after procedures ranging from the simplest plastic to resection.

Causes of Death.—Persistent obstruction by scybalæ, from shock twice, and once apparently from making an artificial anus at too high a level in the small intestine.

The conditions presented by internal obstruction afford the greatest chances for relief by an artificial anus; it is here a proper method of treatment, giving results that compare very markedly with the usual series of disasters that attend its injudicious use.

Miscellaneous.

Twenty cases, 7 deaths.

Constriction of Intestines by the Vermiform Appendix, 7 cases, 2 deaths. The site of constriction was five times the

ileum, once the cæcum, and once the rectum. In one case the operation was abandoned; the cause only being found post-mortem, in others the appendix was excised.

Constriction of the Small Intestine by surrounding Mesentery, 1 case, 0 died.

Stricture of Small Intestine (non-malignant), 3 cases. Artificial anus, 2; died, 1; entero-anastomosis, cured, 1.

Laparotomy for Strangulated Hernia, 5 cases; in two the cause becoming recognized, the operation was further completed by external herniotomy; 1 died from pre-existing peritonitis; in two the operation was completed from within (both cured); in the fifth case, laparotomy was performed for paralysis of gut following herniotomy, cure.

Colotomy for Unknown Causes, 3 cases; 2 died, 1 cured.

Twist of Mesentery, no obstruction, 1 case, cured.

Part II. Gangrenous Hernia.

Three hundred and fifty-four cases; died, 120; mortality, 34 per cent.

Males, 123; died, 34; mortality, 28 per cent.

Females, 209; died 82; mortality, 39 per cent.

Ratio of inguinal to femoral, 1 to 2.

Ratio of inguinal to femoral, males, 12 to 5.

Ratio of inguinal to femoral, females, 1 to 15.

Mortality, ratio of inguinal to femoral, 3 to 4 (26 to 37).

Mortality, ratio of inguinal to femoral, males, 3 to 4 (23 to 33).

Mortality, ratio of inguinal to femoral, females, 1 to 2 (10 to 19).

Site of hernia: right, 154; left, 83.

Mortality, right, 31 per cent.; left, 36 per cent.

Relative frequency of various forms of hernia according to the conditions in which they are seen, strangulated (gangrenous) or non-strangulated.

As a basis, the writer has added up various series (see Maydl)[24] of cases, with a total as follows:

In 61,561 males with hernia in the groin, 2362 are femoral, or as 1 is to 25.

In 12,061 women, 6012 are femoral, or as 1 is to 1.

Berger,[9] from 10,000 dispensary cases, estimates the relative frequency of hernia in men and women as, males 3 to females 1. Macready puts it as 5 to 1. This less marked contrast is probably the most accurate, and the difference may possibly be less, if it is borne in mind that women do not offer such ready means of tabulation by not presenting themselves so constantly for treatment. They are inclined to conceal their condition; it has less affinity with the "objective" genital apparatus than in the male; women are less incommoded by its presence in the discharge of the duties more peculiar to their sex, and they do not seek employments from which they would be barred by the presence of an unsupported hernia. Moreover, they can be more easily relieved by a truss that is not supplied by a skilled surgeon, such as are obtained in drug stores, etc.

Berger[9] estimates that 3.31 per cent. of herniæ are subject to accidents, not necessarily, but chiefly strangulation; for men the probability of such accidents is 2.46 per cent.; for women, 5.84 per cent.

Although the total of women afflicted with hernia is much less than in men, the "accidents" are observed in about the same frequency in both sexes. Berger attributes this fact quite rightly to the greater frequency of femoral hernia in women, this hernia being the most liable to "accidents." He estimates that a woman with an inguinal and a femoral hernia stands a chance of undergoing "accidents" to the extent of 11.8 per cent.; that is, the risk of the inguinal hernia is 2.16 per cent., and for the femoral hernia, 9.02 per cent.

The above may be taken to represent as fair a basis of estimates of the frequency and variety of herniæ in general. The writer's compilation of his cases of gangrenous herniæ shows a marked difference from this "normal" distribution, and he offers a parallel comparison of his estimates of the two varieties.

TABLE VIII.

VARIETY OF HERNIA (BERGER).

	In General.	In Gangrenous Hernia.
Inguinal	84 per cent.	34 per cent.
Femoral	10 "	59 "
Umbilical	5 "	6 + "
Others	1 "	1 — "

VARIETY IN SEX (AUTHOR'S COMPILATION).

	Male.	Female.	Male.	Female.
Inguinal	25 to	1 to	12 to	1 to
Femoral	1	1	5	15
Ratio of hernia in general, men to women	3 to 1		1.2 (37.63)	

INGUINAL HERNIA.

Total, 96; died, 25; mortality, 26 per cent.

Males, 72; died, 18; mortality, 23 per cent.

Females, 15; died, 15; mortality, 33 per cent.

Right side, 50; males, 42; females, 6.

Left side, 26; males, 18; females, 6.

It is evident that the mortality of inguinal hernia is less than in femoral. There does not seem to be any decided factor for this difference, as we are dealing in either case with the extreme degree of damage, that is, gangrene. The operative technique is somewhat more difficult in femoral hernia, especially for inexperienced operators; and this circumstance may perhaps account for part of the difference of 11 per cent. in favor of inguinal hernia. For inguinal hernia is not favored in the distribution of severe cases, as analysis showed that its proportion of more desperate conditions, not permitting of primary enterorrhaphy, was about 15 per cent. greater than in the femoral variety.

BIBLIOGRAPHY.

[1] American Journal of the Medical Sciences, May, 1897.

[2] ANNALS OF SURGERY, Vol. xxvi, p. 353.

[3] ANNALS OF SURGERY, Vol. xxix.

[4] Archiv für klin. Chirurgie, Vol. xxxix, p. 173.

[5] Archiv für klin. Chirurgie, Vol. xl, p. 84.
[6] Archiv für klin. Chirurgie, Vol. xlviii.
[7] Archiv für klin. Chirurgie, Vol. liv, Heft 2.
[8] Archiv für klin. Chirurgie, Vol. lx, Heft 4.
[9] Berger: "Dix milles observations de hernies."
[10] Von Bergmann: St. Petersb. med. Wochenschrift, 1896, No. 44.
[11] British Medical Journal, 1896, Vol. i, p. 113.
[12] Brooklyn Medical Journal, 1897, p. 491.
[13] Centralblatt für Chirurgie, 1896, p. 614.
[14] Centralblatt für Chirurgie, 1895, p. 85.
[15] Centralblatt für Chirurgie, 1893, p. 62.
[16] Cf. article by the writer in Archives of Pædiatrics, February, 1900.
[17] Hahn: Deut. med. Wochenschrift, 1897, Nos. 41-43.
[18] Hinterstoissier: Wien. klin. Wochenschrift, 1895, p. 98.
[19] Hofmokol: Klinisch. Zeit. und Streitfragen, Band vi, Hefte 5 und 6.
[20] Journal de Médecine de Bordeau, 1892, p. 39.
[21] Lancet, 1891, Vol. i, p. 1312.
[22] "La pratique de l'evisceration en chirurgie abdominale," pp. 333, Paris, 1898.
[23] Lyon Medical, 1898, p. 215.
[24] Maydl: "Die Lehre von den Unterleibsbrüche," 1898.
[25] Maylaid: Glasgow Medical Journal, 1896, p. 143.
[26] Medical Record, July 17, 1897: "Mortality and Treatment of Acute Intussusception," by C. L. Gibson. This paper contained 239 laparotomies for acute intussusception, but only the cases operated on since 1887 (149 in number) were used as a basis of results of treatment. This series here recorded comprises thirty-eight additional cases published since 1897.
[27] Medico-Chirurgical Transactions, 1892-93, p. 197.
[28] Mittheil. aus der Grenzgebiet der Medicin und Chirurgie, Band ii, Hefte 2 und 3.
[29] Murphy: Deut. Zeitschrift für Chirurgie, Vol. xlv, p. 54.
[30] Schwarz et Rocard: Rev. de Chirurgie, 1892.
[31] Transactions of the London Clinical Society, Vol. xxvii, p. 205.
[32] Treves: "Intestinal Obstruction," 1899.
[33] Winiwarter: "Billroth Festschrift."

(TO BE CONTINUED.)

MESENTERIC CYSTS.[1]

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THE word mesenteric has often been used in describing cysts within the mesentery, mesocolon, mesorectum, or omentum; and there is an advantage in this use, since these regions, as well as the cysts which they contain, are anatomically similar. Even cysts which were almost entirely retroperitoneal have been called mesenteric.

In the seventeenth and eighteenth centuries a few mesenteric cysts were described. By 1803 enough cases had been recorded so that Portal [1] classified them. In 1886 Augagneur [2] found that eighteen out of ninety cases of tumors of the mesentery were cystic. In 1887 Hahn [3] gave a *résumé* of the subject and classified them as blood cysts, chylous cysts, serous cysts, and the echinococcus cysts. Arekion,[4] in his Paris thesis of 1891, gave reference to eighty-one reported cases. In 1892 Braquehaye [5] added twenty-three to this number, making 104. In 1897 Moynihan [6] contributed a most comprehensive article in the ANNALS OF SURGERY, in which he referred to previous articles and reported nine additional cases. The references given at the end of this article (Nos. 7 to 26) record thirty-two additional cases. This makes a total of 145 cases to which references are here given. Many of these cases, however, are not reported sufficiently in detail to make them really intelligible. The only record is often a statement made by a surgeon in a society meeting, or elsewhere, that he had found a cyst in

[1] Read in part before the New York Surgical Society, December 27, 1899.

the mesentery: the character of the fluid and the difficulties of operation or treatment were referred to; but there are comparatively few reports of the microscopical examination of the cyst wall and the chemical and microscopical examination of the cyst fluid according to the present methods. Such reports are being made more commonly now, and will, without doubt, lead to a better understanding of the subject.

Braquehaye's classification is as follows:

(1) Sanguineous cysts, or hæmatomas, including certain serous cysts.

(2) Lymphatic cysts, including the chylous cyst of authors, and most of the serous cysts.

(3) Parasitic cysts, hydatids.

(4) Congenital cysts, or dermoids.

(5) Cysts of adjoining organs (ovaries, parovarian, head of pancreas, etc.).

Moynihan classifies them as

(1) Serous cysts.

(2) Chyle cysts.

(3) Hydatid cysts.

(4) Blood cysts.

(5) Dermoid cysts.

(6) Cystic malignant disease.

He gives examples under each heading.

We thus see that there has not been a uniformity in classification, and there has been little effort to explain the origin of these cysts.

The following case, which was presented before the New York Surgical Society, had a cyst which adds something to our knowledge of the subject, and suggests, together with the other reported cases, that many of these cysts originated as embryonic sequestrations.

Multilocular Cyst-Adenoma, in Transverse Mesocolon, containing Pseudomucin.

History of Patient and Description of Operation.—General Memorial Hospital. (History, No. 6633.) She is forty-one

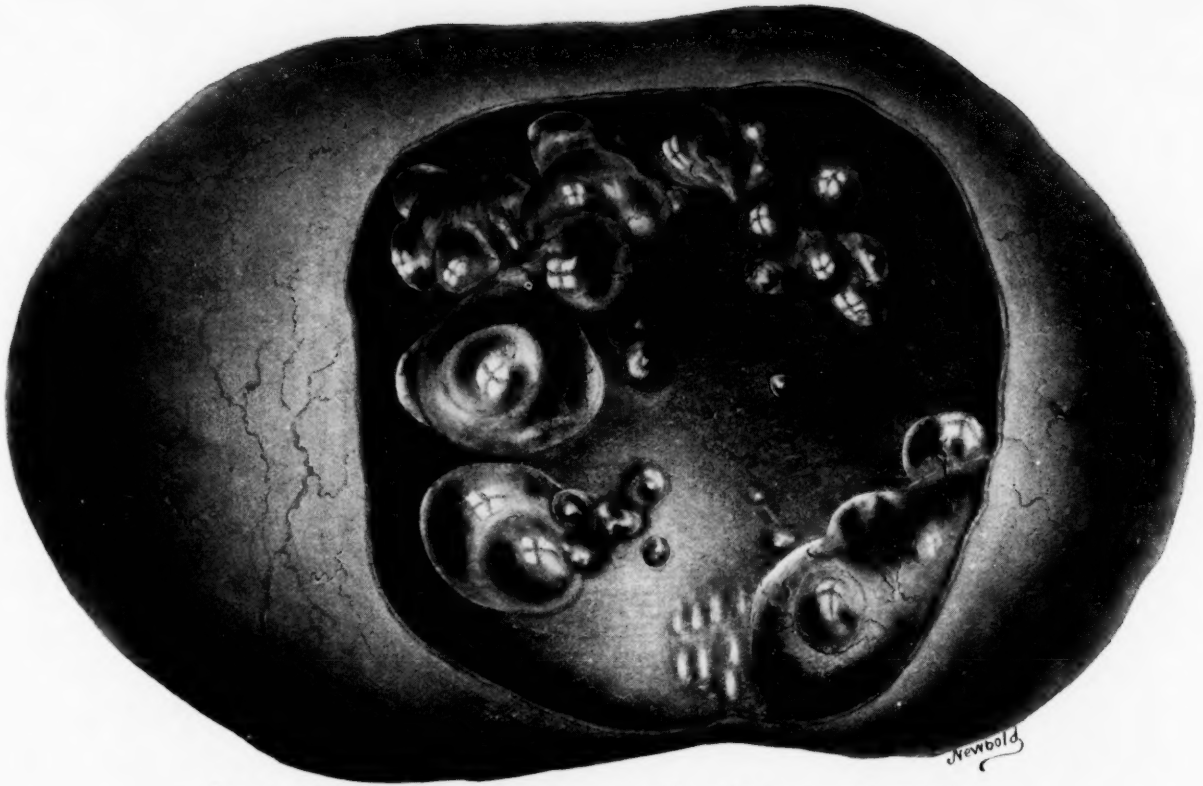


FIG. 1.—Multilocular cyst-adenoma removed from the transverse mesocolon.

years of age, a native of Switzerland, of good family history, of good constitution, and good previous health. She was married twenty-three years ago, had one child twelve years ago, and has been a widow for ten years. Her menstrual history has been normal, excepting the associated gastric disturbance described below. About eight years ago she noticed tenderness in the left hypochondrium and felt a small lump there. She also had indefinite epigastric pain and occasional vomiting, which usually lasted almost the entire day before menstruation. About five months ago she noticed that the lump had greatly increased in size, and since then it has grown somewhat.

Present Examination.—Patient shows nothing abnormal excepting in the abdomen, where there is a tumor which seems to fill the greater part of the abdominal cavity, pressing into the pelvis; it is globular in shape, gives dulness on percussion, and is surrounded on each side by tympanitic resonance, which does not change as she changes her position. There is indistinct fluctuation wave on palpation. After she had worn loose clothing in the hospital for a few days, the tumor no longer pushed into the pelvis, but seemed located in the upper part of the abdominal cavity, and tympanitic resonance existed between it and the pelvis; the uterus and ovaries seemed normal.

Operation was done November 25, 1899. A median incision was made from just below the ensiform cartilage to two inches below the umbilicus. The cyst lay between the stomach and the transverse colon, which it had pushed downward. It was covered by the upper part of the great omentum (the gastrocolic ligament), and an incision was made through this. The various abdominal organs were then examined through this incision; the spleen, both kidneys, the stomach, the liver, the gall-bladder, the uterus and ovaries, were all palpated and found normal. The pancreas was in close apposition to the base of the cyst. The cyst was then tapped and about a litre and a half of viscid fluid withdrawn. It was then drawn through the abdominal incision; it was very vascular; one of the arteries was about the size of the popliteal, and one of the veins about as large as the femoral. No capsule could be separated from its anterior surface, but by drawing it forward and downward until the pancreas came into view a place was found where the peritoneum, which constituted the capsule, could be separated from the rest of the cyst

wall. This separation was then carried on, the vessels being clamped and ligated as they appeared, until the cyst was removed from the abdominal cavity. The extent of capsule which was thus cut must have been ten or twelve inches; after careful examination this was allowed to retract into the abdominal cavity. Although the pancreas was attached to the cyst, there was no pancreatic tissue incorporated in the cyst wall. The cyst was

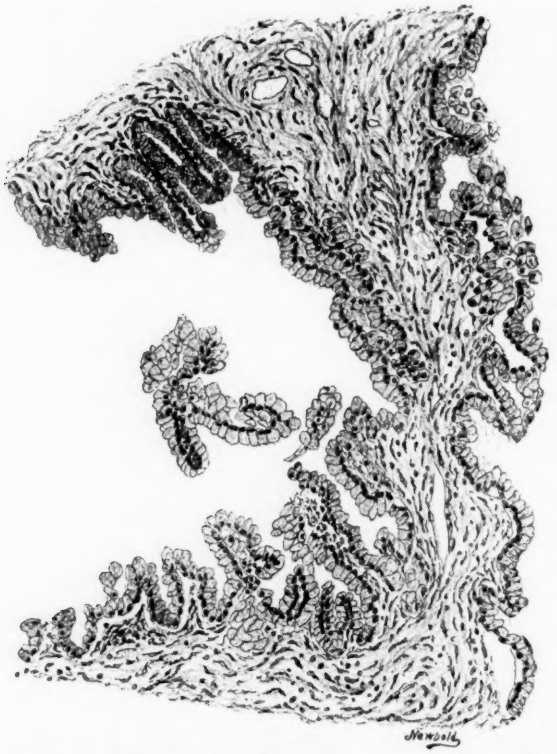


FIG. 2.—Section from wall of small cyst, showing epithelial covering on both sides of the thin fibrous wall.

situated in the transverse mesocolon, and was not a pancreatic cyst.

The patient made a prompt recovery without incident.

Description of the Cyst and its Fluid.—The cyst was found to be globular in form; it contained more than three litres of chocolate-colored viscid fluid; it had a firm wall about two millimetres in thickness. It was covered with peritoneum, ex-

cepting a small area which had been in apposition with the pancreas. On opening it several secondary cysts were found growing from its inner wall and projecting into its cavity. Their appearance is well indicated in Fig. 1. In diameter they vary from one to ten centimetres; their walls were thin and translucent and very vascular, and most of them were filled with clear fluid. In two of them hæmorrhages had taken place, and the fluid was accordingly dark in color. The delicate structure of these secondary cysts gave particularly good opportunity for studying their microscopical structure (see Fig. 2). There was a layer of epithelial columnar cells on both outer and inner walls, and a layer of thin fibrous tissue between them which constituted the fibrous portion of the cyst wall. The epithelial cells were large and columnar, like those of mucous membrane.

The wall of the main cyst was composed of dense fibrous tissue (see Fig. 3) containing a few small cells and spaces which represent blood or lymph vessels. On its inner surface there were indistinct small cells, irregularly arranged, apparently the compressed remnant of the epithelial layer shown on the walls of the secondary cysts.

The entire structure was exactly similar to that of a cyst-adenoma of the ovary; in fact, as one of the demonstrators of pathology said, "The specimen could be used for class-room demonstration of the structure of ovarian cyst-adenoma, and no one could say that it was not such a cyst."

The examination of the fluid from the cyst showed the presence of pseudomucin in large amount. The fluid was of a specific gravity 1010; it was slightly alkaline, somewhat viscid in consistence. That from the clear cysts showed no trace of albumen on the application of heat and nitric acid; that from the cysts where hæmorrhages had taken place showed only the faintest trace of albumen, no more than could be expected from the amount of blood present. Microscopically the fluid showed blood-corpuscles, cholesterin crystals, and large granular cells.

Dr. Phœbus A. Levene, who made the chemical analysis of the fluid, stated that the pseudomucin was exactly like that which is found in ovarian cysts. "The material from colloid degeneration is very closely allied to pseudomucin, differing from it by being insoluble in water. This colloid degeneration may occur in various forms of cystic sarcomatous (or carcinomatous) de-

generation. The pseudomucin in this cyst was soluble in water and corresponded exactly to that found in ovarian cysts."

Kelly [28] gives a very concise statement of the relation of pseudomucin to ovarian cysts, from which I quote: "Pseudo-



FIG. 3.—Section of wall of main cyst, showing the dense fibrous structure without distinct epithelial cells.

mucin is one of the most important of the constituents of the glandular ovarian cystomata, and is almost characteristic. It is particularly abundant in cysts containing the tough, sticky,

mucilaginous substance often capable of being drawn out in long threads." "It is also to Pfannenstiel's credit (*Arch. für Gyn.*, Band xxxviii, 1890, page 407) that he has shown that pseudomucin does not result from a colloid degeneration of the cells as supposed, but that it is a real secretion of the epithelial cells which goes on indefinitely without cell destruction. The various stages through which the cells pass in the formation and excretion of pseudomucin may be beautifully seen in a single cyst."

"Pseudomucin is never found in normal ovaries, dropsical Graafian follicles, or in parovarian cysts; it is found in some forms of papillary cysts, and is, as stated, the constant characteristic element in the classical glandular ovarian tumors."

In its relation to other mesenteric cysts, the cyst here described is remarkable in the following particulars:

(1) It shows the exact structures and fluid contents of an ovarian cyst-adenoma; and hence suggests its probable origin from an embryonic ovarian sequestration.

(2) It shows in the smaller loculi the epithelial structure which explains its growth, and in the main cyst wall the firm fibrous structure which has been found in most mesenteric cysts.

(3) It contained clear fluid in some of its loculi and bloody fluid in others, and showed large blood-vessels in the delicate cyst walls, thus indicating that hæmorrhages from the cyst walls explained the sanguineous fluid, and suggesting a similar cause in other sanguineous cysts.

EVIDENCES THAT THE CYST WAS OF EMBRYONIC ORIGIN.—The occurrence of this cyst in the transverse mesocolon is most suggestive, and leads to inquiry as to its origin. It could not be an ovarian cyst which had become separated from the ovary by twisting of its pedicle, because such a cyst could never have migrated to that locality; it could not have gone through the peritoneum and pushed between the layers of the mesocolon. Furthermore, the ovaries were found of normal size and in normal position. If, however, a portion of the ovary or of the germinal epithelium had been separated from

the rest of the organ in the early process of development, it could easily have reached this location.

The diagram which is here given shows the embryonic genito-urinary organs.

Morris states: "The earliest appearance is that of a tube called the Wolffian duct, which opens by its hinder extremity into the cloaca or common outlet for the intestinal and urinary passages. From the forepart of this duct is developed a tem-

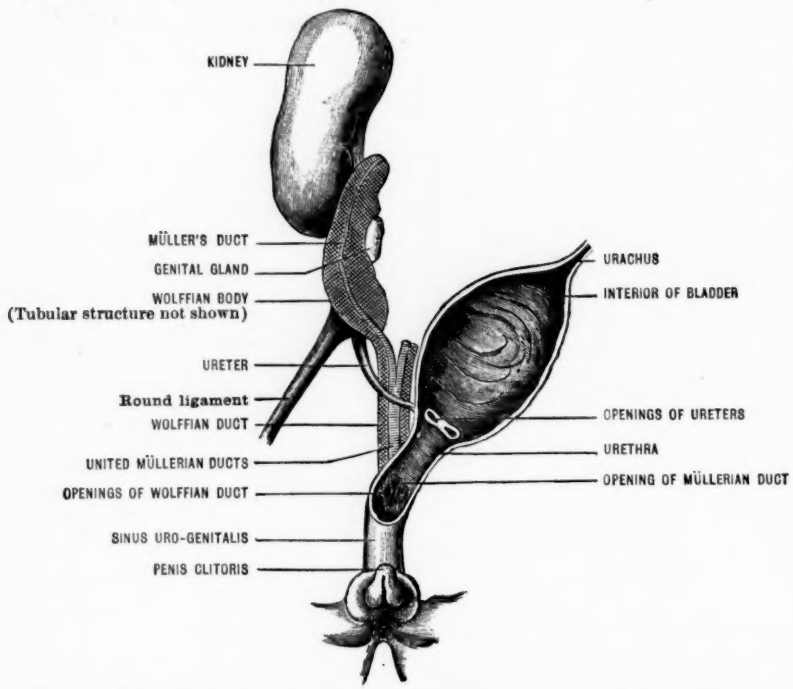


FIG. 4.—Diagram of the primitive genito-urinary organs before differentiation of sex (after Henle), from Morris's "Human Anatomy." Blakiston's Son & Co., p. 1055.

porary organ, the pronephros or head-kidney; from the mid-part is developed the mesonephros, or Wolffian body; from the posterior end of the duct springs the metanephros, from which the kidney is developed. The genital gland arises as a ridge, partly mesoblastic and partly due to a thickening of an epithelial layer; the germinal epithelium is on the inner side of the Wolffian body."

Thus we note that the organ from which the ovary and the parovarian come is in embryonic life close to the kidney.

Now, if we study the primitive alimentary canal (Fig. 5), we see how easily a sequestration from the Wolffian body, or the embryonic genital gland, could be included between the folds of the mesentery.

"The alimentary canal first appears as a simple tube lying about the median line in front of the posterior abdominal parietes and placed vertically. This tube is connected with the posterior parietes by a simple fold of peritoneum, a species of general mesentery."

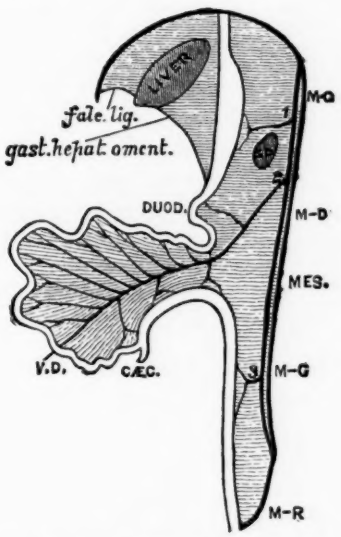


FIG. 5.—Diagram of the primitive alimentary canal, from Morris's "Human Anatomy." Blakiston's Son & Co., p. 993. M. G., mesogaster; M. D., mesoduodenum; Mes., mesentery; M. C., mesocolon; M. R., mesorectum; 1, 2, 3, arteries.

As the alimentary canal becomes differentiated, this "general mesentery" develops with it. The great omentum is formed from the mesogaster and a part of the transverse mesocolon, and the mesoduodenum, mesentery, mesocolon, and mesorectum develop with the growth of the part to which they are attached; thus affording opportunity for the inclusion of an

embryonic structure, if it were present. Moynihan [6] states congenital remnants of the Müllerian and Wolffian ducts and bodies are regularly found between the layers of the mesentery; and of the vitelline duct in close relation to the diverticulum of Meckel.

Instances of Sequestration from Various Organs.—In the growth of the various organs of the body, fragments are occasionally separated from the main part of the organ, and are found in the tissues in localities more or less remote.

For instance, accessory lobules about the thyroid gland have been frequently observed,[30] situated sometimes on the hyoid bone, on the deep portions of the trachea, in the supraclavicular region, in the larynx, on the aorta, and even behind the pharynx.

Accessory thymus glands are not uncommon,[30] they usually lie above the main gland in the vicinity of the thyroid.

Accessory lobules about the breasts have been often described. Williams [31] states that the connection of these outlying processes with the corpus mammæ is often reduced to a narrow pedicle, and not infrequently by its rupture they become completely sequestrated. These sequestrations gave rise to neoplasms identical in structure to mammary neoplasms.

Delafield and Prudden [32] call attention to little rounded nodules, loosely attached to the suprarenal capsule, which have the same structure as the capsules themselves. Rests or sequestrations from the suprarenal capsules have frequently been found within the kidney.

Accessory spleens are not uncommon.[33] The most common situation is in the gastrosplenic ligament. Rokitansky and Klob have each found such an accessory spleen in the head of the pancreas. Double spleens and spleens with deep clefts in them are also described.

An accessory pancreas is occasionally found. It is usually flat, from the size of a lentil to that of a silver dollar, made up of glandular nodules and situated in the wall of the upper part of the duodenum or the stomach; more rarely in the lower part of the duodenum, and sometimes under the serosa; sometimes

in the muscularis and submucosa. The structure corresponds with the pancreas itself, and there is a small duct communicating with the intestine.[30]

Accessory lobes of the lung are also found.[34] Rokitansky has described one which was separated from the normal lung and its bronchi, and which lay between the lower left lobe and the diaphragm. C. W. Collins explains a supernumerary apex lobule by a former adhesion of the lung to the chest wall, so that the vena azygos could not go behind the lung during the descent of the heart, but cut off the adherent piece from the rest of the lung.

Small isolated parts of the liver, which are fastened to the liver by fibrous bands, have been described.[35] E. Wagner has recorded the development of liver tissue in the ligamentum suspensorium.

Cases of true supernumerary kidneys have been described[36] by Blasius (two left kidneys) and Hyrtl (a third kidney in front of the left iliac synchondrosis), besides the two kidneys in their normal positions. Double ureters are relatively frequent. Such a specimen was recently presented to the New York Pathological Society by Dr. Ely;[37] another by Dr. Philips,[38] and others were described by Dr. Biggs.

The placentæ succenturiatæ, which, according to Winkel,[39] are found in 1 to 2 per cent. of all cases, are examples of similar sequestrations.

The various dermoids which are found beneath the skin are due to a separation of the skin elements which result from faulty development.

Supernumerary ovaries have been observed in many cases[30] (Grohe, Klebs, De Sinety, Winkel, Olshausen); the multiplicity being due either to spontaneous subdivision of the embryonic rudiment of the organ, or to mechanical abstraction of one or more portions of it.

This separation of portions of developing organs from the main organ is so common that it need not occasion surprise. The tendency to abnormal development in parts derived from the Wolffian body and the germinal epithelium is further shown

in the frequency of parovarian cysts, ovarian cysts, and cysts of Gärtner's ducts. The congenital cystic kidney is believed by some pathologists [40] to be caused by the inclusion of certain parts of the Wolffian body within the kidney itself.

It is altogether within the bounds of probability that such a separation should from time to time take place from the Wolffian body or the germinal epithelium at an early time in embryonic life; and, if such portions are separated, it is not strange that they should be carried into the mesentery, mesocolon, or mesorectum in the course of their development, and there form cysts such as this one or like many of the others which have been described; or, if they should not be carried into the mesentery, they might develop as retroperitoneal cysts, some of which are certainly similar in structure to the mesenteric cysts; or, if they should be carried into that portion which forms the great omentum, they would form omental cysts, which are also of similar structure.

The indications that this particular cyst is embryonic, and that it was due to the development of an ovarian rest in the mesocolon, are enough to amount almost to a proof; for we have the structure and fluid contents of the cyst, which are exactly similar to those of ovarian cysts; the location which is close to that from which the developing ovary migrated, and the fact that sequestrations or rests from the various organs of the body are of common occurrence.

Considerations with Regard to the Origin of Other Cysts.—After studying the etiology of this cyst, the question naturally arises, How many of the other mesenteric cysts are of embryonic origin?

We are unable to find the record of any other which corresponds exactly to this. A multilocular mesenteric cyst with columnar epithelium on the smaller cyst walls, an absence of epithelium on the main cyst wall, and pseudomucin in the fluid, have not been recorded as far as I know; although the records indicate that such cysts have been observed, but not described in detail.

In the process of cyst building, as shown in ovarian and

parovarian cysts, the fluid comes from three sources:[28] (1) The secretion from the epithelial cells. (2) The transudation from the blood-vessels. (3) The destruction of the cells.

As the process goes on the epithelium is modified and often destroyed. Sutton[41] states, with regard to parovarian cysts, that "when small they are lined with columnar epithelium which is ciliated in some specimens. In large cysts it becomes stratified and in very big cysts it atrophies." Hence, it is altogether probable that many of the mesenteric cysts with fibrous walls and no epithelial lining have at one time been lined with epithelium. There are records of many such cysts which correspond to the description of ovarian and parovarian cysts, and there is a strong probability that they are really of embryonic origin. The rarity of an epithelial lining in mesenteric cysts led Hahn[3] to state that they were without such lining; but Macdonald,[43] Küster,[49] and Studgaard[50] have described cysts with epithelial lining; and Pagenstecher[21] has found epithelial cells in fluid.

Of the cysts which seem similar to the author's, we may mention Macdonald's,[43] a cyst which had first appeared in the upper part of the abdomen and then grown downward. It was adherent to surrounding structures, was apparently situated in the mesentery, and was attached to the spinal column just in front of the aorta and vena cava. It consisted of a main cyst and smaller cysts in its wall. Both the primary and secondary cysts were lined with columnar epithelium "exactly resembling that of an ordinary proliferous ovarian cyst."

The cyst wall was composed of a "loose fibrous network with but few cells, except ordinary connective-tissue corpuscles."

Morton[44] also describes a mesenteric cyst which resembles this in many particulars. "The cyst had a dense white wall of fibrous tissue, and on laying it open there were seen some soft partitions of what looked like fibrin stretched across it. On the interior of the wall at one spot there was a vesicle such as one might see on the skin after the application of an irritant. The fluid was slightly blood-stained, a little viscid, and on standing in the enamelled vessel for an hour spontaneously coagulated into a soft jelly. The wall resembled more that of a miniature ovarian

cyst than any other kind. Microscopic examination of it only showed dense fibrous tissue."

Löhlein [51] describes a cyst which extended back to the spine and down into the pelvis, which compressed the ascending and transverse colon, which had a fibrous wall, and which contained thin, yellow, mucous-like fluid, which in parts was flaky and gelatinous.

Bantock [52] describes a cyst covered by mesentery, which lay in close contact with the kidney, and which contained a glairy mucoid fluid. The cyst was composed of a number of intercommunicated loculi, separated by numerous septa.

Pean [53] reports a large multilocular cyst, extending from under the mesorectum, which contained serous, clear brown, transparent fluid.

Carter [54] records a thin-walled cyst which was very vascular, which was attached to the side of the spine in the left lumbar region, and which contained sixteen pints of thin, clear, slightly opalescent fluid, alkaline; specific gravity 1009; no albumen; large amount of chlorides. No record of examination of cyst wall.

These cases are all enough like the one here reported to make it highly probable that they are of similar origin.

If, now, we take the groups given in the classifications of Hahn, Broquehaye, and Moynihan and examine them in detail, we find indications that very many of them were of embryonic origin.

These classifications include the following groups: (1) Dermoid cysts; (2) Chylous cysts; (3) Sanguineous cysts; (4) Serous cysts; (5) Hydatid cysts; (6) Cysts of adjoining organs; (7) Cystic malignant disease.

Dermoid Cysts.—Dermoid cysts are believed always to be due to an error in development in the ovary or some one of the epithelial structures. They occur chiefly in the abdomen and in places where skin-covered surfaces coalesce during embryonic life, such as the orbital region, the naso-facial sulcus, and along the median line of the body. When in the abdomen they are believed to be of ovarian origin; Cohnheim attributes their origin to inclusion of a part of the ectoderm in the ovary

in early fœtal life and the growth of these elements at a later time. In certain instances they are believed to be due to a blighted ovum which has been included in an otherwise healthy embryo. Those which occur in other places than the abdomen are believed to be due to the inclusion of portions of the skin, or, in some instances of mesoderm or even endoderm, beneath the line of coalescence and corresponding growth at a later time. Teeth are rare, excepting in ovarian dermoids; but they do occur in rare instances in other localities. Mandelbaum [42] refers to such instances in dermoids of the mediastinum, a form which is believed [40] to be due to an inclusion of embryonic elements beneath the surface at the sternal coalescence of the two lateral portions of the body.

There have been records of several mesenteric dermoids. Schutzer [55] records one in which two canines, two incisors, and eight molars were present.

Mayer [12] describes a dermoid larger than a man's head which was taken from the mesentery; it was free from the genitals. The inner cyst wall was smooth and shiny and beset with long black hair; the fluid was yellowish-brown, similar to pea soup. Spencer Wells [56] removed from between the folds of the mesentery one which contained bundles of fine hair and six pounds of fatty material and flattened epithelium. Langton [57] removed a dermoid from between the layers of the mesentery, and another from each ovary. König [58] states that he has observed a dermoid cyst in the mesentery.[1]

These cysts are all believed to be of embryonic origin, and I know of no other theory which explains their formation.

Chylous Cysts.—Chylous cysts have been described in large numbers; they are more common than any other variety of mesenteric cysts. The fluid has usually been described as milk-like, or chylous. That from a case described by Carson was cream-white, specific gravity 1014, alkaline, contained albumen, but no fibrin; microscopically there were large

[1] Lexer, in an article which has been published while this paper was in the printer's hands, refers to several additional mesenteric cysts; he also believes that some of them were due to ectodermic rests from the Wolffian duct. *Archiv f. klin. Chir.*, lxi, p. 648.

granular cells, in some of which the protoplasm had undergone fatty degeneration; there were fat globules and crystals of sodium chloride, also carbonates chlorates, and sulphates. The walls of the cysts are usually fibrous and firm. It has been generally supposed that these cysts are due to a dilatation of some one of the lacteal or the chyliferous vessels, as taught by Rokitansky half a century ago. It has also been suggested that there has been effusion of chyle into previously existing cysts; this seems much more probable. We can see how a duct which has a gland behind it might become cystic if it were occluded; the size of the cyst depending upon the extent to which the pressure of the cyst fluid could distend its wall. It is not easy to understand how this process could take place in vessels so rich in anastomoses as are the chyle vessels. There are records of at least ten cases where the thoracic duct, or one of its main branches, has been wounded and either sutured, ligated, or packed, without evidence of cyst formation.[46] [47] Ziegler[30] states that occlusion of the thoracic duct may be followed by anastomosis, or by distention of the lymph vessels, and mentions the distention of the lacteals into elongated tortuous forms in certain instances where they have been obstructed.

One cannot deny the possibility of cyst formation by this process, but it is unlikely and at variance with ordinary pathological processes. It seems far more likely that chyle should be effused into the cavity of cysts already formed, particularly as lymph nodes have been found in the walls of mesenteric cysts,[62] [48] [21] thus indicating the presence of lymphatic structures; and spaces are seen in the cyst walls which are apparently lymph channels.

In chylous ascites we have an example of the effusion of chyle, and in chyluria we have a condition which is in some respects similar. In the ordinary process of cyst formation, it is believed that serum transudes from the blood-vessels into the cyst cavity; and in the author's specimen and many others we have examples of extravasation of blood into the cyst fluid. In the case of Ducasset[59] there was a multilocular cyst in which some loculi contained yellow serous fluid, with no evi-

dence of chyle, and others contained white chylous fluid. In Demon's [60] case of multilocular cyst one loculus contained blood and the others chylous liquid. In Rasch's [61] case, where the cyst wall was sewed to the abdominal wall, there was an oozing of chylous fluid for a short time after the cyst had been emptied. Küster [49] describes a chylous cyst which was lined with epithelium, a lining which would not have existed in a dilated lymph vessel; and Pagenstecher [21] has described one, in the fluid of which there were degenerated flat epithelial cells.

Taking these cases together, it seems pretty well established that the chylous cysts are really preformed cysts, situated in such close relation to the lacteals that chyle has been effused into them and that they are really of embryonic origin, in structure similar to ovarian and parovarian cysts.

Sanguineous or Blood Cysts.—The cysts which have been described as sanguineous or blood cysts have usually contained bloody fluid similar to that in the author's case.

Morton's [44] cyst, for instance, which is referred to above, has been described as a blood cyst, although the fluid is only "slightly blood-stained." Hahn [3] describes one which contained 400 centimetres of thin brownish-red fluid. The wall was four millimetres thick, smooth, and shiny on the outer side; from the inner side there were vessels hanging in the cyst cavity, which were evidently the remnants of previously existing septa. These were apparently preformed cysts into which hæmorrhage had taken place. The vessels in the cyst walls are so abundant and so delicate that one can easily understand the occurrence of this hæmorrhage; and the presence of clear fluid in some loculi and blood-stained fluid in adjoining ones indicates the steps of the process.

There have also been hæmatomata in the mesentery; but the tendency of hæmatomata here, as elsewhere, seems to be towards absorption and not towards the formation of cysts with walls of definite structure, such as are found in the mesentery.

Fisher [63] has written at length on peritoneal sanguineous

cysts, but all of his cases seem to be hæmatomata of comparative short duration, or previously existing cysts into which hæmorrhage had taken place.

It would seem that the cysts with bloody fluid should be classified according to the structure of their walls and the chemical character of the fluid, and that the hæmatomata should be considered simply as hæmatomata, and that the classification blood cysts need not be used unless further observations should make it desirable.

Cysts with the Walls which suggest Intestinal Structure.—There is a variety of cyst not mentioned in the classifications above given which may be naturally considered at this point. Cysts with muscular fibres or other elements so arranged as to suggest the structure of the intestine.

The most remarkable one was recorded by Studgaard,[50] who gives a very careful description and good pictures. It was in the mesentery, contained 200 cubic centimetres of chocolate-colored fluid, and had a funnel-like process, or pedicle, thick as one's thumb, which had to be severed in removing the cyst, the cut extending through the different layers of the cyst wall. The inner surface of the sac was in parts smooth and shiny, another part had the appearance of mucous membrane, and section through this showed a layer of tubular glands tightly packed together, with a membrana propria, a single layer of cylindrical epithelial cells and a perceptible lumen; beneath this layer there was a muscularis mucosa, then a submucous layer of connective tissue, then a layer two millimetres in thickness composed of smooth muscle fibres running parallel with the circumference of the aperture in the cyst wall; and outside of this another layer—half as thick—composed of smooth muscle fibres running at right angles with those of the first layer, then connective tissue and serosa. "The cyst wall was therefore in perfect agreement as to structure with the wall of the intestine, save that in the latter we do not find an irregular hypertrophy of the tubular glands with degeneration of the superficial layer which was shown here; nor were Peyer's patches or solitary glands shown." On the smooth portion of the cyst wall this layer of villous mucous membrane was represented by a connective-tissue layer contain-

ing pigment and epithelial cells irregular in formation and arrangement. The situation in the mesentery is not given.

Eve [19] has described a cyst removed from the mesentery of the jejunum which had in its wall three layers of unstriped muscle fibres. The section showed the middle layer cut transversely and the other two longitudinally. He refers to specimens in Museum of Royal College of Surgeons, No. 2352 E, from girl of nine, which had a considerable quantity of unstriped muscle tissue in its walls.

Fehleisen [10] has also described a multilocular cyst which contained 8200 cubic centimetres clear reddish-brown fluid, and had unstriped muscle fibres in the cyst walls. The walls contained three layers: (1) outer, dense connective tissue; (2) median, very vascular connective tissue, loosely arranged; (3) internal layer exclusively unstriped muscle fibres, arranged longitudinally but with large bundles having a more or less irregular construction. "The muscle fibres were characteristic; they differed in no respect from those found in intestinal tract or bladder."

Brentano [22] also describes a mesenteric cyst in the wall of which there were smooth muscle fibres under the serosa. The fluid contained fibrin and degenerated blood-cells.

Unstriped muscle fibres may sometimes be demonstrated in the wall of ovarian cysts, but not in such large amount or in such definite layers as those here recorded. The natural explanation of Studgaard's case is that it was due to a sequestration or diverticulum from the intestine. This definite intestinal structure could hardly have come from any other source, and a part or all of the other cases are apparently of similar origin, but less perfectly developed.

Serous Cysts.—Serous cysts have been referred to by many observers, but it is very difficult to find descriptions which show us just where to classify them.

The following three cuts (Figs. 6, 7, and 8) are taken from Moynihan's article published in the ANNALS OF SURGERY, July, 1897, Vol. xxxi, page 1.

The fluid in each of these cysts was pale, clear, straw-colored, specific gravity 1015-1016, alkaline, and contained a large amount of albumen.

No description of the cyst walls is given. The wall of the next cyst described, which was similar, was, however, referred to as white and fibrous.

Braithwaite [26] removed a cyst from the great omentum which contained three and one-half pints of clear watery fluid, and described the wall as thin and of the bluish color seen in an ordinary ovarian cyst.

Jessett [64] describes a multilocular cyst of the great omentum

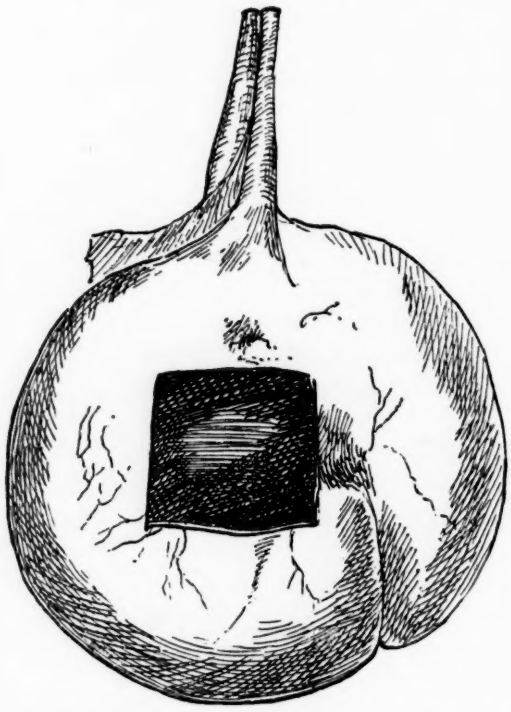


FIG. 6.—Unilocular cyst of the mesentery. Normal size.

which contained serous fluid, but does not describe the cyst wall. He refers to five similar cases recorded by other observers.

Eve [19] gives a very careful description of two cysts which occurred in young children, one eleven weeks and the other three and two-thirds years of age.

The fluid in the first was turbid serum, containing white and red blood-corpuscles but no fatty corpuscles; $^{5}/_{120}$ of albumen; the walls were three lines in thickness and showed no endo- or

epithelial lining, but contained three layers of unstriped muscle fibres (as previously described).

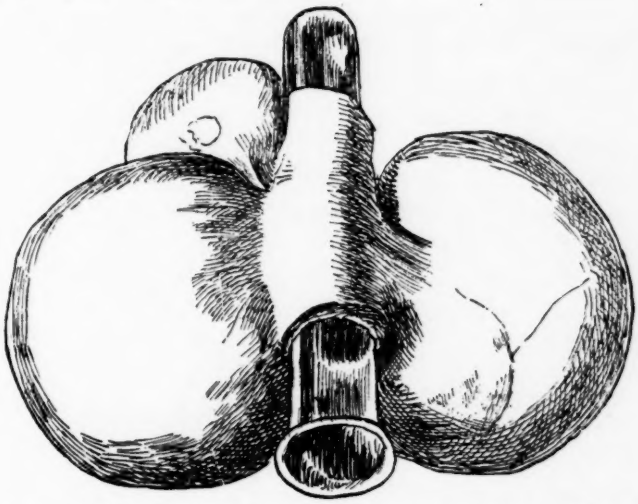


FIG. 7.—Multilocular cyst of the mesentery. One-third natural size.

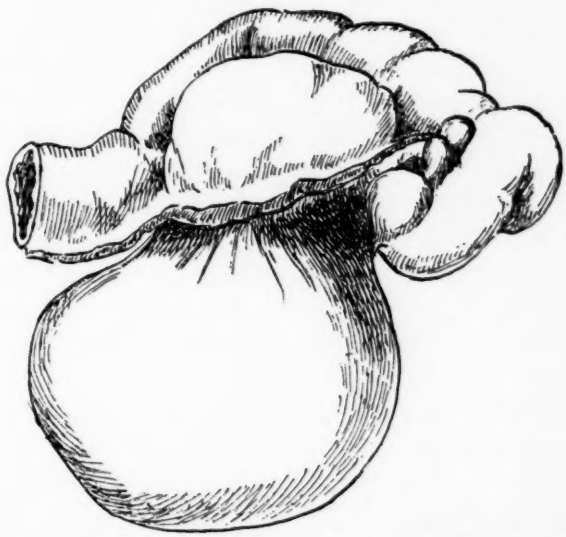


FIG. 8.—Multilocular cyst of the mesentery. One-half natural size.

The cyst in the second case contained thirty-two ounces of clear, straw-colored serum, which became solid on boiling, and

contained a large quantity of cholesterin but no fatty matter. It was seven feet above the ileocæcal valve, between the layers of the mesentery; the walls were extremely thin, their under surface smooth. Under the microscope there was no lining shown; "the inner half was composed of connective tissue, containing granulation cells, and the outer half of loose connective tissue and fat. No unstriped muscle tissue."

Frentzel [65] records a mesenteric cyst, treated by Luecke, which had smooth, shiny walls, and contained 100 cubic centimetres of brown serous fluid, in which yellow "granular cells like those of an ovarian cyst" were found. (V. Recklenhausen.)

Obalinski [66] has contributed an article on serous retroperitoneal cysts, and described such a cyst which contained three litres of clear watery fluid, with 12 per cent. of albumen and chlorides and traces of earthy phosphates. The wall was one millimetre thick and composed of firm connective and elastic tissue. He also refers to an article by Przewski, in which other similar cases are reported, and the origin from the Wolffian body or Müllerin duct suggested.

So far as these cases are described, they correspond closely to those forms of ovarian and parovarian which contain serum, the fibrous wall and the serous fluid being the elements upon which this similarity rests. They can with propriety be considered as of probable embryonic origin; they bear a close resemblance to the other cysts which we have considered. Whether the fluid is exuded from blood-vessels in the form of serum, or whether it is secreted from the cells which line the cyst, seems to be largely dependent upon the structure of the cyst wall, and the close resemblance between these serous cysts and serous cysts of the ovary and parovary is very suggestive.

Gairdner,[67] nearly fifty years ago, described a remarkable serous cyst of the omentum which I have not included among the epithelial lined cysts, since it is not easy to interpret the microscopical reports of that time. It should surely be referred to, however.

The cyst was in the great omentum, between three and four feet in length, one-half to one and one-half inches in breadth,

having a lobulated appearance like a distended colon, but no complete septa. Sac highly transparent, vascular.

Fluid transparent, colorless; serum, containing numerous flocculi, which microscopically showed the ordinary filamentous appearance of fibrinous or albuminous matter, entangling various nuclei and imperfect forms of epithelium evidently detached from inner wall of cyst.

"Nor did the examination of the interior of the cyst membrane (so far as it could be pursued without altogether spoiling the preparation) reveal any more organized structure than that of an epithelial membrane."

It is worthy of note that most of the serous cysts occur in the omentum, intestinal edge of the mesentery, mesocolon, or retroperitoneal region, while the cysts which occur in the mesentery, excepting at the intestinal border, usually contain chyle. Heinrichs [15] has reported a case which is an exception to those previously described in that it has endothelial cells on both the outer and inner surfaces of its walls. It was in the ascending mesocolon and contained four litres of clear, watery, albuminous fluid. Photographs of the cyst and microscopical drawings of the cyst wall are given. It is to be expected that future cases will throw light upon this one.

Hydatid Cysts.—Hydatid mesenteric cysts form a class by themselves, and are due to a specific cause, the growth of the Tænia echinoccocus. Nannotti [13] has written a most comprehensive article on hydatids of the mesentery, and has collected twenty-nine cases, sixteen of which were described as anatomical and were examined post-mortem; thirteen were described as clinical. Several of the cases had hydatids elsewhere.

In making the diagnosis of hydatid cysts, the hooklets or the peculiar laminated structure of the cyst wall should be found. Cases have been described as barren hydatids in which no hooklets were found, and in which there was no record of the characteristic cyst wall. The diagnosis was made on the character of the fluid, which was of a specific gravity of 1010 or less, contained no albumen, but abundant chloride. Fluid

of this nature is not diagnostic of a barren hydatid, as is shown by the case which the writer reports. It is not impossible that some of the cases which were so reported were really embryonic cysts which contained pseudomucin.

Cysts of Organs adjoining the Mesentery sometimes push themselves between the mesenteric folds, a process, for instance, which might take place with a pancreatic cyst. It seems better, however, to consider such cysts under the heading of the organ from which they grow.

Cystic Malignant Disease does not often occur in the mesentery, so that the cyst greatly exceeds the solid part of the tumor. Keen,[27] however, has reported a cystic sarcoma of the omentum in which the fluid weighed ten pounds.

DIAGNOSIS, PROGNOSIS, AND TREATMENT.—These elements have been carefully considered by other writers, and this paper has already exceeded its expected length. In most instances the cyst is movable, giving an area of tympanitic resonance on all sides, and it is not connected with the pelvic organs. The symptoms are mostly those which come from the mechanical pressure of the tumor; there is usually pain; there is often constipation and vomiting; and there is sometimes emaciation, which is believed to come from interference with the chylous circulation.

These tumors, as a class, are among the serious abdominal lesions, but many of them are so situated as to be removed without difficulty. The treatment, unless there are some strong contraindications, would be exploratory incision, removal of the cyst if practicable, sewing it into the abdominal wound, and draining it if removal is not practicable. Aspiration is to be avoided.

Jessett [64] has successfully enucleated a cyst and resected a piece of intestine which was included in its wall, and united the cut ends of the intestine. This procedure has also been done with solid tumors of the mesentery.

SUMMARY.—(1) The occurrence in the transverse mesocolon of a multilocular cyst-adenoma which contained pseudomucin, and which was exactly like a cyst-adenoma of the

ovary, suggests its probable origin as an embryonic ovarian sequestration.

(2) The occurrence of dermoid cysts in a similar position suggests a similar origin.

(3) The occurrence of chylous cysts in the mesentery, which have the structure and appearance of ovarian and parovarian cysts, and which have in their walls lymph vessels, suggest embryonic cysts into which there has been an effusion of chyle.

(4) The sanguineous cysts appear to be preformed cysts into which hæmorrhage has taken place; hæmatomata in the mesentery should not be described as cysts.

(5) The presence of cysts which have the structure of the intestinal wall suggest sequestration from the intestine.

(6) Serous cysts are apparently similar in origin and structure to the cysts already considered. They are usually not situated in the path of the lacteal vessels.

(7) Hydatid cysts form a class by themselves and are due to the Tænia echinococcus.

(8) Reports indicate that mesenteric cysts are being removed at least as often as once a month. If microscopical examinations of the cyst walls and chemical and microscopical examinations of the cyst fluid are made, the entire subject should soon be understood.

(9) It is probable that all mesenteric cysts may be included in the classifications

(1) Embryonic cysts.

(2) Hydatid cysts.

(3) Cystic malignant disease.

BIBLIOGRAPHY.

[1] Portal: Cours d'anátomie médicale ou éléments de l'anatomie d l'homme, t. v. Paris, 1803.
[2] Augagneur: Tumeurs du mésentére. Thèse d'agregation. Paris, 1886.
[3] Hahn: Berlin klin. Woch., 1887, p. 408.
[4] Arekion: Étude sur les kystes du mésentère. Thèse Paris, 1891.
[5] Braquehaye: Des kystes du mésentère. Archiv. gen. de méd. Paris, September and November, 1892.
[6] Moynihan: ANNALS OF SURGERY, Vol. xxvi, 1897, pp. 1-30.
[7] Grüneberg: Zur Casuistik der Mesenterial Geschwulste. Deutsch. med. Woch., 1896, Vol. xxii, p. 376.
[8] O'Connor: Chylous Cyst of Mesentery, Operation, Recovery. New York Medical Journal, 1897, Vol. lxv, p. 458.
[9] Thomas: Cysts of Mesentery, ANNALS OF SURGERY, Philadelphia, 1897, Vol. xxvi, p. 527.
[10] Fehleisen: Muscular Fibres in Wall of Mesenteric Cyst. Progressive Medicine, San Francisco, 1899, Vol. i, pp. 15-18.
[11] Beach: Chylous Cyst of Mesentery, Operation, Recovery. Boston Medical and Surgical Journal, 1898, p. 489.
[12] Mayer: Dermoid Cysts of Mesentery. Wein. klin. Woch., 1898, Vol. xi, pp. 1075-1077.
[13] Nannotti: Sulle cisti da echinococco del mesenterio. Policlin. Roma, 1899, Vol. vi, pp. 31-48.
[14] Kümmell: Beiträge zu der Cysten des Mesocolons. Festschrift zur Feier seines 70 jährigen Geburtstages. Friedrich von Esmarch, Kiel und Leipzig, 1893.
[15] Heinrichs: Beitrag zur Lehre von den Mesentereal Cyst. Beitrag z. Geburtsch. u. Gyn. Festsch. Aug. Martin, Berlin, 1895, pp. 76-86.
[16] Hoover: Removal of Chylous Cyst from Mesentery. Transactions of the Ohio Medical Society, Toledo, 1895, Vol. i, pp. 363-365.
[17] Hofmokl: Cyst im Mesenterium, Laparotomie (heilung). Jahrb. d. Wien. K. K. Krankenhaus, 1895, Wein und Leipzig, 1897, Vol. iv, Pt. II, p. 263.
[18] Adam: Diag. Treat. Cyst. Mesent. Bull. Méd., Paris, 1895, Vol. ix, pp. 539-542.
[19] Eve: On Mesenteric Cysts, with Two Cases in Young Children subjected to Operation. Medico-Chirurgical Transactions, London, 1897-1898, Vol. lxxxi, 51-63.
[20] Ludlam: Large Suppurating Cyst Mesentery, Enucleation. Clinique Chicago, 1895, Vol. xvi, p. 265.
[21] Pagenstecher: Two cases. Cyst bildung im Mesent. Berl. klin. Woch., 1896, Vol. xxxii, pp. 911-914.
[22] Brentano: Ueber mesenterial Cysten. Deutsch. med. Woch., 1895, Vol. xxi.
[23] Jessett: Multilocular Cyst of Great Omentum. British Gynæcological Journal, London, 1896-97, Vol. xii.

[24] Marfan: Kyste Multiloculaire du grand epiploon. Rev. prat. d. trav. de med., Paris, 1896, Vol. liii, pp. 105-107.
[25] Apert: Calcified hydatid cysts great omentum. Bull. Anat. de Paris, 1897, Vol. lxxii, p. 950.
[26] Braithwaite: Note on a Cyst of Great Omentum removed by Operation. Lancet, 1898, Vol. ii, p. 1472.
[27] Keen: Cystosarcoma of Omentum. ANNALS OF SURGERY, 1898, Vol. xxvii, pp. 220-224.
[28] Kelly: Operative Gynæcology. Appleton, New York, 1898, Vol. ii, pp. 160-162.
[29] Morris: Human Anatomy. Philadelphia, 1898, pp. 1055-1056.
[30] Ziegler: Lehrbuch der speciellen, Path. Anat., 7 ed., Jena.
[31] Williams: Diseases of the Breast. London, 1894.
[32] Delafield and Prudden: Hand-Book of Pathological Anatomy and Histology. Third edition, New York, p. 400.
[33] Birch-Hirschfeld: Lehrbuch d. Path. Anat. Fourth edition, Vol. ii, p. 197.
[34] Birch-Hirschfeld: Lehrbuch d. Path. Anat. Fourth edition, Vol. ii, p. 482.
[35] Birch-Hirschfeld: Lehrbuch d. Path. Anat. Fourth edition, Vol. ii, p. 708.
[36] Birch-Hirschfeld: Lehrbuch d. Path. Anat. Fourth edition, Vol. ii, p. 793.
[37] Ely: Transactions of the New York Pathological Society, 1894, p. 91.
[38] Philips: Transactions of the New York Pathological Society, 1897-98, p. 182.
[39] Winkel: Text-Book of Obstetrics, Philadelphia,, 1890, p. 59.
[40] Sutton: Tumors, Innocent and Malignant, Philadelphia, 1893, p. 255.
[41] Sutton: Tumors, Innocent and Malignant, Philadelphia, 1893, p. 401.
[42] Mandelbaum: A Case of Dermoid Cyst of the Mediastinum. American Journal of the Medical Sciences, July, 1900, p. 64.
[43] Macdonald: Edinburgh Medical Journal, Vol. xxx, 1885, p. 1074.
[44] Morton: Lancet, Vol. ii, 1896.
[45] Rokitansky: Lehrbuch der Path. Anat., Vienna, 1856, Third edition, Vol. ii, p. 394.
[46] Cushing: ANNALS OF SURGERY, 1898, Vol. i, p. 719.
[47] Munter: Deutsch. med. Woch., 1899, No. 48.
[48] Werth: Archiv f. Gynæcol., 1882, p. 323.
[49] Küster: Ein chirurg Triennium, 1882, p. 158.
[50] Studgaard: Hospitals Tidende, 1894, p. 641.
[51] Löhlein: Berl. klin. Woch., 1889, Vol. xxvi, p. 557.
[52] Bantock: Lancet, 1887, Vol. i, p. 568.
[53] Pean: Diagnostic et Traitement des Tumeurs de l'Abdomen et du Bassin, Paris, 1880, Vol. i, p. 1112.
[54] Carter: British Medical Journal, January, 1883.
[55] Schutzer: Abhand. der schwed. Akad., Band xx. Quoted by Moynihan.
[56] Wells: British Medical Journal, June, 1890.

[57] Langton: Lancet, 1889, Vol. ii, p. 1065.
[58] König: Lehrbuch, 5. Auf., Band ii, p. 221.
[59] Ducasset: Bulletins de la Soc. Anatomique de Paris, 1848, p. 67.
[60] Demons: Quoted by Braquehaye, p. 304.
[61] Rasch: Lancet, November 23, 1889, p. 1064.
[62] Merklen: Bullet. de l'Acad. de Méd., Paris, 1880.
[63] Fisher: Guy's Hospital Reports, Vol. xlix, 1892, p. 275-333.
[64] Jessett: British Gynæcological Journal, 1896-97, Vol. xii, p. 156.
[65] Frentzel: Deutsch. Zeitschr. f. Chir., Vol. xxxiii, 1892, p. 129.
[66] Obelanski: Wiener klin. Woch., 1891, Vol. iv, p. 719.
[67] Gairdner: Transactions of the Pathological Society, London, 1851-52.

DISLOCATION OF THE HUMERUS, COMPLICATED BY FRACTURE AT OR NEAR THE SURGICAL NECK.[1]

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THIS injury is a comparatively rare one, and it seldom falls to the lot of a surgeon to see three cases.

Up to the year 1894 there had been reported 117 cases of dislocation of the shoulder-joint, complicated by fracture of the humerus in its upper portion. No single observer had reported more than five cases. In January of that year, McBurney read a paper before the New York Surgical Society, which was published in the ANNALS OF SURGERY for that year, in which he reports one case. Since that time there has been only one other case reported so far as I know, and that by McBurney in 1896. This, together with the three which I have the honor to report to-day, makes a total of 122 cases.

The injury is an important one, on account of the difficulties encountered in treatment and the very serious impairment of function resulting in a majority of the cases reported up to the publication of McBurney's article in 1894.

The form of dislocation usually found in these cases is the subcoracoid variety, the head being displaced downward and inward, lying under the coracoid process. It is also sometimes rotated on its axis, in which case the fractured surfaces are carried farther apart. It is not at all surprising that this should be the form of dislocation found in these cases, as we know

[1] Read before the Colorado State Medical Society, June 20, 1900.

that in the simple, uncomplicated cases the subcoracoid variety makes up about 75 per cent. of all cases.

As to the seat of the fracture, we find that of the 122 reported cases, the fracture was said to have existed at the surgical neck in seventy-three; at the anatomical neck in twenty-eight. In eleven of the cases, it was said that the fracture "occurred at the neck." In six, there was fracture both of the anatomical and surgical necks, and in three cases it was simply stated that the fracture was in the upper part of the humerus.

In two of the cases which I report, the line of fracture was through the surgical neck, in the other case it was somewhat below that point. The direction of the line of fracture has varied in all these cases, but in the cases I have seen the line was oblique and the direction of obliquity was upward and outward. The upper end of the lower fragment usually lies external to the small fragment and is drawn upward towards the glenoid cavity.

As to the history of injury and the mode of production, we find that this has not been accurately noted. McBurney and Stimson both say that it is quite probable that in a large number of the cases the injury was produced in the usual way, namely, by sudden abduction of the arm carried to the point of hyperabduction, as often results from falls upon the extended arm or upon the elbow; and that the fracture takes place through continued abduction, combined, perhaps, with forced rotation, the edge of the glenoid cavity, or the acromion process, acting as a fulcrum.

In the cases which I have seen, the injury has resulted from direct violence inflicted at the seat of injury either from a fall or a blow upon the shoulder. It is quite reasonable to suppose that in some of the cases the original injury was a simple dislocation, and that the fracture was the result of violence at the hands of the surgeon while attempting to reduce the dislocation.

Diagnosis.—This is sometimes far from easy, especially when the injury to the bony structure is accompanied by a large amount of contusion and swelling of the soft tissues. But if

the surgeon will bear well in mind the landmarks and signs of each injury, he should not make a mistake.

We rely for diagnosis upon the following signs: First, the absence of the head of the bone in the glenoid cavity and its presence in a new location under the coracoid process, which can be made out even in a very fleshy subject and where there is a large amount of contusion and swelling. Second, there will be a sharp outline to the shoulder, caused by the prominence of the tip of the acromion process. Third, the circumference of the shoulder measured through the axilla will be increased. Fourth, the arm will be freely movable and can be easily approximated to the side, which would not be the case in a simple, uncomplicated dislocation, excepting where there had been a complete laceration of the capsular ligament. Fifth, the head of the humerus would not rotate with the shaft of the bone in rotation of the arm. This sign is the most important of all, as it removes all doubt about solution of continuity in the humerus, and, as I have already said, one should always be able to make out the head and feel it under the fingers. Measurements of the upper arm will show shortening and crepitus may be felt. Lastly, should there be any doubt as to the conditions present, the X-rays should be utilized to clear up things.

Prognosis.—Until within the last few years, the prognosis was decidedly bad as far as restoration of function of the extremity was concerned. In only a few of the cases seen was it possible to restore the head of the bone to its normal position in the glenoid cavity. In some of the cases, the fracture was treated and nothing done with the dislocation, with the idea in view that, after union of the fracture had taken place, the dislocation could be reduced. There is no successful case of this kind on record. Others endeavored to prevent union of the fragments, and to establish a false joint at the seat of fracture. The results from this method were only partially successful. Others, again, resorted to open incision of the joint and resection of the upper fragment; this, too, was not satisfactory.

In six of the 122 cases, the head was reduced through an open incision of the joint; and in all six it was necesssary to remove the upper fragment either at the time or subsequently. There have been four cases recorded now, including my own, where the dislocation was reduced, by the method which I will describe, with results that were entirely satisfactory. In the light of my own experience, I should say that, whereas the injury is certainly a grave one, the prognosis under proper treatment is fairly good.

Treatment.—The treatment of this particular injury has excited interest for many years, even as far back as the year 1835; and all the authorities have been united in the opinion that here we have a condition hard to cope with, and one where the results have been far from satisfactory. All surgeons have been agreed upon one thing, namely, that when a fracture and a dislocation of the same bone exist, the dislocation should be remedied first and the fracture last. Reference to authorities prior to the year 1894 show that each and every one of them advise that every endeavor should be made by direct manipulation, by extension and leverage, under an anæsthetic, to reduce the dislocation. It is also recorded by them that these methods were usually unsuccessful.

We find that in event of failure there were several methods of procedure advised: First, to treat the fracture and obtain union, leaving the head of the bone in its new position with the hope that a new socket would be formed that would be of some service; second, to prevent the fractured surfaces from uniting by daily manipulations, thus causing a false articulation to form at the seat of fracture, which might, in a measure, act as a substitute for the normal shoulder-joint. These procedures are certainly both unsurgical, and are not to be thought of at the present time; third, to secure union of the fracture and then make an attempt at reduction of the dislocation. This is also to be condemned, for we can never be certain that union will take place; and, if it does, it may be delayed long beyond the usual length of time, and every week of delay means a diminished chance for reduction of the dislocation.

Then, again, union may take place with a large amount of deformity, owing to the fact that the small, upper fragment cannot be properly adjusted or held in place. Oger reports ten cases where this was done, and in only three of these was it possible to reduce the dislocation afterwards. Of the methods for reduction advised, the only one which to my mind seems justifiable is that of attempting to force the head of the bone into the glenoid cavity by direct pressure. Extension will avail nothing, as the force will be expended in pulling the fractured surfaces farther apart, and there is certainly great danger of doing irreparable damage to nerves, blood-vessels, and soft tissues in the neighborhood.

In one of the cases I reported, there had been considerable damage done to the soft tissues before I saw the case, by the long continued and repeated use of extension and pressure with the foot in the axilla. In one of the cases reported, death followed these manipulations, and was said to have been the direct result thereof.

The reason why these cases are so difficult to manage is that, owing to the shortness of the upper fragment and its deeply buried position, one is not able to grasp it for the purpose of producing extension. After going carefully over the literature of this subject prior to 1894, one can but feel that the methods advised were crude, unsurgical, and unsuccessful. The question is, Have we anything to offer to-day which is better? We have presented to us for our consideration two procedures: First, a resection of the small, upper fragment; second, cutting down upon the seat of fracture, exposing the upper fragment, and then, by means of a hook or forceps, pulling the head of the bone into the glenoid cavity. Of all these methods, I feel that resection should be excluded, or at least should not be thought of until everything else had failed, as it could certainly only leave the arm badly crippled. Opening the joint, liberating the resisting portion of the capsule, thus allowing of the easy reposition of the head of the bone, is certainly a procedure which is not contrary to good surgical

practice, and might possibly be considered in a certain number of cases.

The last procedure is the one which I especially desire to speak of,—the one first advised by McBurney. An incision is made on the outside of the arm and over the seat of the fracture, exposing the lower end of the upper fragment. A hole is then drilled on the side of the fragment and about three-fourths of an inch from the lower end. Into this hole is fitted the end of a specially constructed hook. Traction is then made in a line at a right angle to the body, the arm being held up by an assistant. It is usually a fairly easy matter to pull the head of the bone into the glenoid cavity. After this has been accomplished, the fracture is to be adjusted, and, if thought best, can be held in place by one of the numerous methods in vogue, such as wiring or the use of steel nails. The wound is then dressed and a dressing of plaster of Paris applied, extending from the neck to the hand.

McBurney had some doubt as to whether the bone would stand the amount of traction necessary to pull the head into place. He conducted some experiments with fresh bones and found that they would easily stand a strain of 175 pounds, which is more than would ordinarily be used in reducing a dislocation of this character. I have used this method in two of my cases with this modification: Instead of using the hook, I used a pair of forceps, so constructed that the end of the bone could be grasped without any danger of crushing it; the only portions of the forceps coming in contact with the bone were two sharp points on each jaw. These points would penetrate the periosteum and bury themselves in the bone without doing any damage.

Case I.—Mr. B. H., aged forty-two, single, consulted me, giving the following history: One year previous to this time, while in the woods chopping logs, a tree fell upon him, threw him to the ground and, striking him upon his right shoulder, produced a dislocation of the shoulder-joint and a fracture of the humerus at the surgical neck. He consulted a physician at that time, who made every reasonable endeavor to reduce the

dislocation of the humerus, but was unsuccessful. He then applied splints to the fracture to maintain the fragments in position for eight to ten weeks; at which time the splints were removed, and it was found that only partial union had been secured. When he was seen by me, there was fibrous union of the fracture; the head of the humerus lay underneath the coracoid process. In view of the fact that the head of the bone had been out of the glenoid cavity for one year, I determined that the proper thing to do was, first, to secure union in the fracture, and then, if it seemed advisable, to institute some operative procedure, with the idea in view of forming a new joint, or cleaning out the old glenoid cavity and making an effort to restore the head of the bone to its normal position. I therefore operated upon the fracture, cutting down upon the fragments; resected the ends; secured them to each other by means of silver wire; a plaster-of-Paris dressing was applied from the neck to the hand. After a rather prolonged period of time, union was secured in the fracture. The patient then left the city, and I did not see him again for three years, at which time he was on a visit to Denver, and I had an opportunity of making an examination of his arm. I found union perfectly solid in the fracture. He had quite free motion of the bone in its new position underneath the coracoid process. This motion, supplemented by a freely movable scapula, enabled him to use that arm almost as well as the uninjured one, as is evidenced by the fact that, after he left the city, he was employed by a telephone company in Chicago as a line repairer, being obliged to climb poles to repair wires. He tells me that he experienced no inconvenience whatever.

This case well illustrates one of the older methods of treatment of which I have made mention above, where it is advised to secure union of the fracture and leave the dislocation alone, and the result obtained in this case would certainly be called a good one.

CASE II.—Thomas W., aged forty-two, single, a miner, on May 31, 1897, fell down a slope in a mine fifty feet, striking several timbers on his way down; this served to break the force of the fall. He was taken out, and when examined was found to have innumerable contusions all over the body. It was also

found that he had sustained a dislocation of the right shoulder-joint. Several attempts were made by the surgeon at the mine to reduce the dislocation, but without success. He was brought to Denver, and I saw him seven days after the injury, at which time I found a large amount of ecchymosis and swelling about the shoulder-joint, in the axilla, and along the arm, some of which I attributed to the repeated manipulations. He was placed under an anæsthetic, and it was found that he had a subcoracoid dislocation of the right shoulder and a fracture of the surgical neck of the humerus. Whether this occurred at the time of the accident or was due to manipulations, I could not discover. Direct pressure was used to a moderate extent to try and reduce the dislocation, but without success. I then cut down upon the fracture, and with forceps grasped the lower end of the upper fragment, and, by exerting traction in a line at a right angle to the body, succeeded with a slight pull in reducing the dislocation. The fracture was adjusted, the ends being held in position with silver wire. The wound was stitched, dressed, and a plaster-of-Paris splint applied, extending from the neck to the hand. After three weeks he was sent home and placed under the care of the local surgeon, who later reported complete recovery and good use of the arm.

CASE III.—J. D., aged thirty-five, married, was thrown from a wagon, striking upon his shoulder and arm, among some boulders. When I saw him, I found he had a badly swollen and contused shoulder. Examination showed the head of the left humerus to be lying underneath the coracoid process, and from the mobility of his arm there was apparently a false joint below the glenoid cavity. The arm could be approximated to the side and the head could be felt to remain stationary when the arm was rotated. The arm measured a little more on this side than on the uninjured side. A diagnosis was made of dislocation complicated by a fracture. Attempts were made to reduce the dislocation, under ether, by direct pressure and gentle traction. This was unsuccessful. An incision was then made down upon the seat of fracture and traction carried out by means of forceps, as in the other case. Somewhat more difficulty was encountered, but by combining a slight amount of rotation and extension, reduction was accomplished. The fractured surfaces were held in position by the use of silver wire, as in the previous

case. The wound was stitched, dresssed, and a plaster-of-Paris splint applied from the neck to the hand. The case pursued a perfectly normal course, and recovery with a perfectly useful arm resulted.

In both of these cases I was surprised at the small amount of force which was required to pull the head of the bone into the glenoid cavity. Both of these cases recovered with perfectly useful arms. The results were as good as is usually seen in a simple, uncomplicated dislocation of the shoulder.

From the experience I have had in these cases, I would say that when a surgeon sees a case of this kind, he is justified in using a moderate amount of direct pressure, under an anæsthetic, to reduce the dislocation; that extension with the foot in the axilla is to be condemned; and that if a very moderate amount of manipulation does not accomplish anything, he should then proceed to cut down on the fracture and reduce the dislocation according to the method of McBurney.

REMARKS ON THE TECHNIQUE OF PROSTATECTOMY, WITH REPORT OF A CASE.

By HERMAN MYNTER, M.D.,

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THE recent interesting discussion on prostatectomy in the New York Surgical Society, published in the ANNALS OF SURGERY of June, 1900, leads the writer to publish the following case, not only because the operation is still under discussion, but also because the method used offers some radical changes from Alexander's operation. It can scarcely be denied that the suprapubic cystotomy advocated by Alexander, in order to be able to crowd the prostate down into the perineum by two fingers in the bladder, at best is a serious complication in old and weak patients, and forces them to stay in bed longer than otherwise would be necessary. Parker Syms [1] advises, in order to avoid the suprapubic cystotomy, to make a laparotomy just above the vesical fold large enough to introduce the hand, in order to press the prostate well down into the perineum through the intact bladder wall. While this may be preferable to the cystotomy, it may add a good deal of shock to the operation, and may, in spite of antiseptic precautions, be followed by peritonitis. It also necessitates prolonged staying in bed. Nichol's method, also, has the disadvantage of a suprapubic cystotomy. Syms mentions in a foot-note that Alexander in two cases, in very thin subjects, was able to dispense with the suprapubic cystotomy, as he found it possible, with one hand behind the symphysis, to push the prostate towards the perineal incision.

Dr. A. B. Johnson [2] has recommended, as a modification of Syms's method, to make a small incision above the pubes, but without opening the bladder or the peritoneum, and with

[1] ANNALS OF SURGERY, March, 1899. [2] ANNALS OF SURGERY, June, 1900.

a finger introduced through this incision crowd the prostate downward. He did this successfully in a small man.

In order to make the operation an ideal one, we should, it seems to me, be able to dispense with all suprapubic operations and to enucleate the hypertrophied lobes of the prostate through the perineum without opening the urethra, and without draining the bladder, unless the cystitis should demand it. That it is possible to dispense with the suprapubic cystotomy, even in a large and fleshy man, my case shows. Under deep narcosis, I was able to crowd the prostate down into the perineum with a hand above the pubes and examine and palpate even its upper border with a finger in the rectum. I, therefore, gave up the suprapubic cystotomy and did the whole operation through the perineum, not only with ease, but, by adopting a different incision, absolutely under the eye. I extended the posterior end of the longitudinal incision, from the bulbus urethra to the anus, in a curve around the anterior half of the anus on both sides; dissected loose the curved flap containing the anterior wall of the rectum, and exposed the prostate to sight. With a grooved stone sound in the urethra, in order to be able to feel the prostatic urethra plainly during the enucleation, I made a median incision in the middle line of the prostate posteriorly, but without opening the urethra; introduced the finger, entered the capsule and enucleated with ease both hypertrophied lateral and middle lobes, meanwhile pressing the prostate down into the perineum with the hand above the symphysis pubis. Unfortunately, the prostatic urethra was torn on one point low down by contact of the finger with the rather sharp edge of the stone sound, and I therefore drained the bladder for seven days through the tear. How far it is possible to avoid tearing the urethra during the enucleation, I am not prepared to state. A soft Mercier's catheter, however, will be a sufficient guide during the enucleation, and with care, I believe, the tear can be avoided. In that case it will be the ideal operation for prostatic hypertrophy, devoid of danger, except possibly through infection of the prostatic veins. With the floor of the bladder uninjured, with no suprapubic

cystotomy, with no drainage through the perineum, and with an intact urethra, the patient may be allowed to leave his bed in a few days. If drainage be necessary on account of the cystitis, a permanent catheter may be introduced through the urethra and left as long as necessary, or the urethra may be opened secondarily through the perineal wound. The weight of the removed lobes was 2¾ ounces, 0:88 gramme, sufficient to show the enormous hypertrophy of the prostate in this case. The history of the patient is as follows:

Mr. M. H., sixty-seven years of age, entered the German Deaconesses Hospital on June 14, 1900. Had always enjoyed good health until he, about fourteen years ago, suffered from inflammation of the bladder of unknown cause. He was sick for three months, had bloody urine, frequent urination and pain, but recovered by internal medication and washing out of the bladder. About four years ago he had retention of urine after a debauch and heavy drinking. A physician was called, but was unable to introduce a catheter. Twenty-four hours later another physician succeeded in introducing a catheter and emptying the bladder of a large amount of urine, said to have been about two quarts. The urine was clear, and after catheterization for a few days, he was again able to pass it without instruments, but slowly and with some straining. A year later he had another attack of retention; catheters were used a few times, and for a month there was considerable blood in the urine. He had no pain and urinated comparatively easily. Two years ago, another physician diagnosed prostatic hypertrophy and performed double vasectomy. He seemed to improve for a time, but the symptoms returned, and for more than a year he has been obliged to pass his water every two hours day and night, and with considerable pain and distress. The intervals have gradually become shortened, and he is now obliged to pass water about every hour. He is a large, heavy man, weighing 240 pounds, otherwise healthy looking. He complains of chronic constipation and hæmorrhoids. A Mercier's catheter shows four ounces of residual urine. The urine is slightly alkaline; contains large amount of blood and pus cells; no albumen in the strained urine; large amounts of phosphates. There is no apparent atrophy of the testes. By rectal examination the prostate is felt as a large, hard, globular mass as large as a medium-sized orange.

June 15, 1900.—Examination under chloroform narcosis. By bimanual examination the prostate could be pressed down towards the perineum in such a degree that the whole posterior surface could be palpated, and the upper margin be felt by the finger in the rectum. After washing out the bladder, a grooved stone sound was introduced into the bladder with the patient in the lithotomy position; the perineum incised in the manner described; the prostate exposed to sight; its capsule split, and the hypertrophic lateral and middle lobes, weighing twenty-two drachms, enucleated with ease. The prostatic urethra was torn inside the capsule, and a large drain, therefore, introduced into the bladder. The cavity in the prostate was packed with iodoform gauze. The curved part of the incision was sutured. The patient bled considerably during the afternoon and evening; the bleeding being venous in character. A number of small clots were washed out of the bladder through the drain. He was put on a milk diet, and ordered urotropine, seven grains, every four hours, with a sitz-bath, morning and evening. The bladder to be washed out every four hours.

June 19.—The temperature was ranging about 100° F.; the gauze packing was removed; the hæmorrhage has ceased.

June 22.—Drains removed, feels well, but still some rise of temperature; pulse 94.

June 24.—Considerable tenesmus of the bladder with retention of urine. A metallic catheter was introduced with ease, and the bladder emptied and washed out. The urine was alkaline in reaction and odor. Albumen abundant, but no albumen present in a strained sample. Microscopically, it contained pus and blood cells, amorphous phosphates, and triple phosphates. Injection of a 2-per-cent. solution of silver nitrate.

June 28.—Has to be catheterized every four hours on account of bladder tenesmus. Urine acid in reaction, clearer, and much less offensive, but contains still pus, blood, and phosphates. Patient is sitting up.

June 30.—Slept whole night without catheterization. Still pus in urine and tenesmus after having retained the urine four hours. Repeated injection silver nitrate, 2 per cent.; urotropine 7½ grains, and boracic acid 6 grains, alternately every two hours. The wound in perineum is granulating and contracting. Occasionally he passes water both through the penis and the perineum,

but generally the bladder must be emptied with the catheter every four hours.

July 2.—Normal pulse and temperature, tongue clean, appetite good, urine contains less pus; there are less frequent spasms of the bladder. Urine passes still almost exclusively through the perineal wound.

July 4.—Instillation into bladder at night of orthoform, 15 grains; salt solution, 1 ounce.[1]

July 8.—He has thereafter had no spasms, been able to sleep the whole night and retain the water. It commences to pass through the penis, the perineal wound is rapidly contracting, the urine is acid, without alkaline smell and with very little pus.

June 12.—Urine normal without pus or blood. Almost all urine passes now through the penis. He feels strong and healthy; sleeps six hours without voiding his urine, and then without spasms. Discharged to his home.

September 6.—Patient has since improved steadily. In August he complained of severe burning in glans penis after micturition. By Bigelow's evacuator several teaspoonfuls of small concrements of urates, probably the result of the injection of the insoluble orthoform, were removed, and the burning promptly disappeared. He sleeps through the night, and is able to void his urine in the morning in a big stream when lying in bed. Towards evening, however, he is obliged to use a catheter in order to empty his bladder. There seems to be a valve or fold at the neck of the bladder which closes the entrance into the prostatic urethra when he stands erect. By examination through the rectum, with a stone sound in the urethra, the whole prostate is noticed to be absent, and the sound is felt just outside the rectal wall. A lateral scarification with Bottini's apparatus will probably remove this obstruction with ease.

[1] Orthoform has been recommended partly on account of its anæsthetic action, partly on account of its antifermentative action on alkaline urine. See Münchener med. Wochensch., Nos. 2 and 3, 1900.

SUPRAPUBIC RETROCYSTIC EXTRAPERITONEAL RESECTION OF THE SEMINAL VESICLES, VASA DEFERENTIA, AND HALF OF THE BLADDER.[1]

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Report of Case.—T. C. H., aged forty-eight years, married, was admitted to the Johns Hopkins Hospital on account of frequency of urination accompanied by pain. Inquiry revealed no family history of tuberculosis, nor of cancer. He had had chicken-pox and scarlet fever; no typhoid; no lung trouble. Until present illness had been generally healthy. No venereal history; has a child fifteen years old. He states that twenty-two years ago he suffered with pain in perineal region, when he saw Dr. Agnew, who told him his prostate was laterally enlarged, and prescribed sitz-baths. No difficulty in urination present then. This trouble lasted three or four weeks, after which he was well for five years. He then had another spell, characterized by pain in the region of the anus and a constant desire to defecate, but not by urinary trouble. This lasted three weeks. Sitz-baths again given. After that the patient was perfectly well, except whenever he took cold, when he would have a little trouble in the prostatic region. No fistula formed. No increased frequency of urination, no blood, no dysuria.

Present illness began, he thinks, December, 1897, with frequency of urination and burning. No difficulty in voiding, no blood, no fever, no chill, no calculus. He thinks it followed a cold and hard work. Trouble slowly but continually increased in severity for six months, during which time his work was

[1] Read before the Johns Hopkins Hospital Medical Society, June 4, 1900.

laborious. His symptoms then were frequent and painful urination (three or four times at night). Improvement followed a little vacation, but again symptoms gradually got worse.

In August, 1898, patient saw Dr. Tyson, who sounded the bladder and examined the urine, made a diagnosis of cystitis, and prescribed ergot, fifteen minims, t. i. d. During the next fall and winter the symptoms got much worse. In November the right testicle began to swell, beginning as a small nodule at lower end, in which there was very little pain, but simply at times a slight aching. The nodule gradually increased in size.

In January, 1900, he became a patient of Dr. Ball, who suspected tuberculosis, the diagnosis of which was confirmed by Dr. Coplin, who found tubercle bacilli in the urine. Injections of iodoform were prescribed. At this time the patient was urinating about every half-hour. In August, 1899, castration was performed on right side. The "testicle" was then the size of an egg, but there was no fistula present. Since then the patient has voided about once an hour; a great deal of pain accompanying and being greatest at the end of urination. There was never a marked hæmaturia, only small clots of blood being passed occasionally. An evening pyrexia with an aching pain in the back was often present.

Status Præsens.—The patient urinates about every hour night and day. There is considerable pain at the end of urination, located, he thinks, in the prostate. He now weighs 119 pounds and has not lost much since the beginning. His appetite is always fine, but he has had to take cascara regularly on account of constipation.

Examination of Urine, April, 1900.—Urine obtained after irrigation of anterior urethra (sent by mail). Very purulent, acid; tubercle bacilli present in fair number.

Physical Examination, May 16.—A thin, pale man. Lungs clear; heart normal; abdomen soft. Kidneys not palpable nor tender. Spleen not palpable. No tenderness over region of bladder.

Genito-Urinary Examination.—Penis normal in appearance, no discharge. Right testicle absent. Stump of cord felt just below external ring; rather hard, about one centimetre in diameter, but not tender. Left testicle; epididymis and vas apparently normal.

Cystoscopic Examination under Chloroform.—Catheter passed easily. After about fifty cubic centimetres of fluid had been forced into the bladder, efforts at expulsion began; but no hæmorrhage occurred. After frequent irrigations and more force, 100 cubic centimetres were passed into the bladder at a time, but some bleeding was produced in so doing. Very many washings were required before cystoscopy could be done, and even then the fluid was clouded, and the examination therefore not perfectly satisfactory. The small size of the bladder also greatly interfered. The mucosa in the region of the vesical orifice looked normal. The trigone was thrown into folds, looked irregular and contracted, but no disease was present. The ureteral orifices were not found, owing probably to the absence of the usual landmarks. Very little time could be given, however, to search for them. Behind the region of the ureteral openings the mucous membrane was much congested, thickened, thrown into folds and inflamed; but this could only be examined for a short distance, owing to the contracture of the bladder and the consequent inability to see the posterior wall and vertex, where the disease was apparently localized. The patient took anæsthesia badly, but his recovery from it was rapid.

Rectal Examination.—No hæmorrhoids, no ulceration of rectum, nor fistula found. Prostate about normal in size, smooth, symmetrical, soft, not tender and not nodular; apparently not diseased. At the upper end of the prostate is an irregular, hard nodular mass, more extensive in the region of the right seminal vesicle and vas, but also evident on the left side, the two masses being connected by softer median tissue. There is no tenderness, nor fluctuation present, and the superjacent bowel is not adherent. The vasa deferentia and seminal vesicles are not individually distinguishable.

Urine.—Acid. Moderately cloudy. No albumen in filtered specimen. Microscopically, pus cells.

Remarks.—The disease was apparently localized to the vasa deferentia, seminal vesicles (possibly only the right), and the posterior wall and vertex of the bladder. There seemed to be scant hope of being able to perform the operation necessary to remove the diseased structure, owing to the weakness of the patient.

Operation, May 17.—Chloroform and ether. Suprapubic

cystotomy; cystoscopy through suprapubic wound. Disease found to involve the entire posterior wall and vertex. Dissection of peritoneum from bladder; separation of rectum from base of bladder; excision of seminal vesicles and vasa deferentia out as far as the abdominal rings; excision of upper posterior half of bladder. Complete closure of bladder; retained catheter; suprapubic drainage.

A median suprapubic incision was made. The peritoneum extended down as far as the symphysis covering and closely adherent to the vertex of the bladder, which was greatly thickened and much contracted. A small incision was made into the bladder, a Nitze cystoscope inserted through it, and a careful examination made, the bladder being kept clean by a stream of water through the urethra. This cystoscopic study was more satisfactory than the one previously done through the urethra, and showed the vertex of the bladder contracted into a long funnel shape, and the mucous membrane deep red in color, with quite a number of ragged ulcerations scattered about its surface.

The trigone was so irregularly contracted that the ureters could not be found, but the disease was apparently localized back of this region. On account of the extent of the disease on the posterior wall and vertex, it was deemed advisable to close up and not attempt a radical operation; but as the patient's physician, Dr. Ball, thought that death during the operation would be preferable to the patient and his wife, than existence in his previous condition, it was decided to attempt it. Knowing that the operation would be bloody and tedious, an intravenous transfusion of salt solution was begun by Dr. Pancost. This was continued throughout the operation. The peritoneum was slowly dissected from the posterior wall of the bladder. In order to get sufficient room for operative manipulation, it was found necessary to divide the rectus muscle on each side, transversely, about three inches above the symphysis. When the region of the ureters was reached, an attempt was made to catheterize them; but, although the bladder had been freely opened, it was impossible to find the left ureter owing to the irregular contracture of the mucosa in the region of its orifice, and only after a protracted search was the right ureter located and the catheter inserted. It was then found that the upward traction of the bladder (for exposure of the posterior surface of the base) had entirely changed the direc-

tion of the ureters, which, instead of lying in juxtaposition to the bladder wall for some distance, ran directly upward, meeting it at right angles. Another interesting feature was the discovery that the vasa deferentia were apparently more closely adherent to the peritoneum than the bladder wall, and were carried back with it by the dissection of this membrane from the bladder. They were not encountered until the seminal vesicles were reached, when it was very easy to trace them out to the internal ring on each side and divide them at these places.

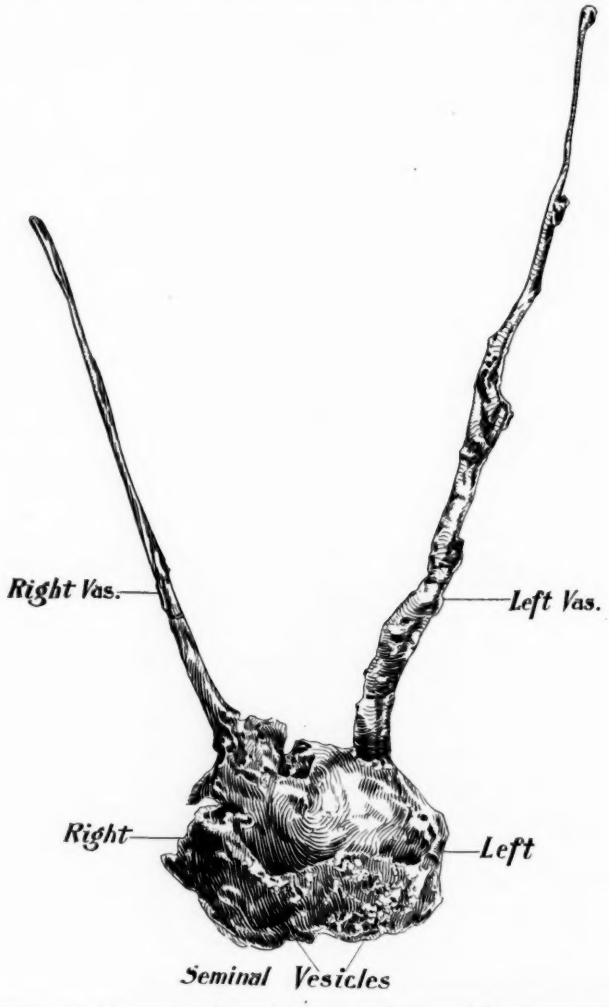
The rectum having been pushed back from the bladder, the hard, irregular mass of the seminal vesicles was freed from surrounding adhesions, and then cut off close to the upper end of the prostate and removed in one piece with the vasa deferentia, which had been followed out to the abdominal rings and cut off there. (See Fig.) Several fusiform cheesy nodules were to be seen in the right vas, and the mass of vesicles and vasa below contained caseous masses. About one-half of the bladder was then excised, the incisions, including the entire posterior wall and vertex of the bladder, being carried very close to the ureteral orifice on each side and extending forward to the anterior wall. Owing to the extensive area of the disease, very little margin could be given it, and it was questionable whether the removal had been complete in the left half, but subsequent examination seems to show that it was.

The bladder was then closed with interrupted silk sutures, placed about one centimetre apart. No reinforcing sutures were used owing to the length of the operation and necessity for haste. Gauze drains were placed in the prevesical space around the very diminutive bladder which was left. The divided ends of the rectus in each side were approximated as well as possible with silver sutures. Considerable difficulty was experienced owing to the tearing apart of the muscle fibres, a mishap which could not be prevented by including the fascia in the sutures. On the left side the incision had been made in the linea transversa, and better approximation was secured.

Hæmorrhage was never an alarming feature, the vessels being clamped and oozing areas controlled by gauze packs.

The operation had been so prolonged by efforts to find and catheterize the ureters, and then to locate the vasa deferentia, that the total amount of blood lost was considerable; and had it

not been for the simultaneous intravenous transfusion which was kept up to the end of the operation (2300 cubic centimetres



Photograph of the vasa deferentia and seminal vesicles removed in one piece, with some intervening tissues. The vesicles have been much changed and matted together by disease, so that they came out in one mass and cannot be separately distinguished. The atrophy of the right vas is well shown.

of salt solution being injected), I feel sure the patient would not have survived the ordeal. The facial color at the end was very

pale and of a peculiar slightly bluish hue, a very uncomfortable picture, but the pulse was reassuring, being only 120 and of fairly good quality.

At the end of two weeks there is for the first time a leakage from the bladder. Patient is doing well.

Pathological Report.—Specimens consist of (1) a piece of the urinary bladder; (2) the seminal vesicle and vasa deferentia removed in one piece.

(1) The bladder specimen when spread out flat measures eight and one-half by five centimetres and is nearly two centimetres thick. The mucous surface, which has been greatly changed by handling during operation, presents a mottled, dark-red, irregular surface, with here and there shallow depressions of a dirty gray color. After some search, three cavities, the openings of which were not visible before, are found,—one about five millimetres in diameter and deep; another, about one centimetre in diameter and five millimetres deep; the other smaller and irregular. These do not look like typical ulcers; the edges are not indurated, and are a little undermined; the surface of a dirty yellow but not of a sloughy appearance. No extensive ulcers or any superficial or deep tubercles to be seen. No cheesy material.

(2) The mass of vesicles measures six by four by two centimetres, and to this is attached the two vasa deferentia, each about sixteen centimetres long. The right is small, atrophic, but has a distinct nodular swelling about its middle, containing cheesy material. The left vas is about normal in appearance and size. The vesicles are so matted together and changed as to be indistinguishable from each other, forming an irregular nodular mass. On section several fairly large caseous abscesses are cut into.

METHODS OF REACHING THE SEMINAL VESICLES.—In the *Journal of Cutaneous and Genito-Urinary Diseases* for December, 1899, Bolton has presented a very interesting paper on "the operative routes to the seminal vesicles." The author details a case of tuberculosis of the epididymis and vas deferens in which, after castration, an attempt was made to remove the entire vas through an enlarged inguinal incision. It was found possible to follow and remove the vas back to the point where it winds around the ureter, but further than this it was impossible to go. He therefore decided to adopt the

sacral method, using the Rydygier incision, making a lateral flap of the fifth sacral vertebra and coccyx, and exposing the prostate by pushing the rectum to one side. The wound was quite deep, but the vas and vesicle were easily removed, both being normal at that point of junction with the prostate.

In discussing the routes by which the vesicles may be reached, Bolton says they are three in number,—the inguinal, the perineal, and the sacral.

The inguinal has been shown to be impracticable. The perineal he thinks unsatisfactory because the vas cannot be followed except for a short distance, and, owing to the depth of the wound, the vesicle and vas can only be extracted forcibly by means of forceps.

In reference to the sacral route he says, " The advantage of this method over both the inguinal and perineal operations consists in the fact that all the steps are carried out directly under the eye, and that there is therefore little risk of accidents peculiar to operations done chiefly in the dark and by touch alone."

All three routes mentioned by Bolton are, of course, inapplicable to cases such as the one here recorded, in which tuberculous disease of some portion of the bladder coexists. Unless a cystoscopic examination has shown the bladder to be free from disease, the method employed by us would seem to be the better method, as giving an opportunity for carefully examining the bladder and the removal of any localized area of tuberculosis.

In our case the extensive involvement of the vertex and posterior wall rendered the peritoneum very adherent over a large area; but, although the separation of the peritoneum from the bladder was tedious, there was never much danger of tearing through it.

It would therefore seem that in cases with little or no bladder involvement it would be very easy to reach the vesicles by this route.

Forcible upward traction of the bladder materially aids

in this process, and brings the region of the vesicles well up towards the abdominal wound.

Several minor points in technique became evident during the operation and may be enumerated as follows: It is well not to carry the dissection of peritoneum too far to each side, *i.e.*, to confine it more or less to the median line, as by doing this one may avoid dividing many of the nutrient arteries of the bladder. Another advantage is that by so doing one need have little fear of dividing the ureters, as they are separated by a distance of two inches or more.

The upward traction on the bladder also makes the course of the ureters more evident by putting them on tension, elevating them from their usual deep location between the bladder and rectum, and causing them to join the bladder at right angles rather than obliquely. Preliminary catheterization of the ureters is hardly necessary if these points be borne in mind.

It seems much easier to locate the vasa deferentia low down near where they join the vesicles, from which point it is an easy matter to follow them out to the abdominal rings. In our case much time was wasted trying to find the vasa deferentia high up, where, owing to the fact that they were carried back from the bladder with the peritoneum and were surrounded by the subserous fat, they were hard to find. In cases of single or bilateral testicular tuberculosis, it would probably be well to perform castration in the groin under cocaine before administering a general anæsthetic.

When the prostate is definitely involved and the posterior wall of the bladder not involved, the operative problem is considerably changed, and, unless the disease be localized to the upper posterior part of the prostate, the retrocystic operation would not be appropriate.

I have under observation now a case of tuberculosis of both epididymes, seminal vesicles, and prostate with limited ulcerative condition of the left antero-lateral wall of the bladder adjacent to the vesical orifice, and hope to gain his consent to an operation for a complete removal of the disease by an operation in front of, rather than behind, the bladder. In

this case, an appropriate plan would seem to be to seize the prostate through a suprapubic wound with vulsellum, divide the membranous urethra, and, drawing the prostate upward and backward, to dissect out the vesicles and vasa, and, dividing the latter either above or below, to withdraw them from around the ureters. Sufficient of the neck of the bladder could then be removed and the cavity left to close around a permanent catheter, or possibly an attempt be made to diminish the vesical opening and draw it down towards the triangular ligament by sutures. Such an operation, I feel sure, would be perfectly feasible, and leave a functionating bladder.

In cases of tuberculosis of the seminal vesicles, with or without disease of the epididymes, but without involvement of the prostate and anterior part of the bladder, I believe the disease can be more easily and completely removed by the method I have employed in the case here reported than by any of the methods now in vogue.

EXCISION OF THE RIGHT VAS DEFERENS AND VESICULA SEMINALIS FOR SECONDARY TUBERCULAR DISEASE.

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THE vesiculæ seminales may be the seat of acute inflammation secondary to urethritis, malignant or tubercular disease. Operations on these organs are rare; one reported by Mansell Moullin [1] for the relief of pain following vesiculitis, the others for tubercular disease.

Tubercular disease may be primary or secondary, usually the latter. Fuller [2] does not believe that tuberculous disease of the prostate is common, but that disease of the seminal vesicles is, and is frequently mistaken for prostatic enlargement. Most modern text-books dismiss the subject with a few sentences. In a recently published text-book one writer says, "If the tubercular disease is secondary, operation is hardly a legitimate procedure;" another merely records that the operation had been performed.

The field for the operation is necessarily limited, as it practically always follows disease in the epididymis and testicle. Conditions now recognized in the early stages and removed before infection has spread along the cord.

From the fact that in my limited field I have found one case where the disease was not arrested by the removal of the scrotal contents and high dissection of the cord without any clinical evidence of disease elsewhere, I am led to believe that, were we to examine the rectum more as a routine practice,

we would find more frequently involvement of the seminal vesicles.

I need scarcely say that there are already on record several cases of excision of one or both vasa deferentia and vesiculæ. The fullest review on this subject of operative treatment which I have come across is contained in a recent article by Longuet.[3] According to him, the first operation for removal of vesiculæ seminales was performed by Ullmann, of Vienna, in 1890; the next by Villeneuve in 1891, and in the same year Roux, of Lausanne, reported two cases before the French Chirurgical Congress. The first case upon this Continent is attributed to Weir, of New York, in 1895, and later cases are reported by Schede, of Hamburg; Gueillot, Baudet and Kentdirdjy, all in 1898.[4]

Three chief methods have been employed for the operation; these are:

(1) By means of the inguinal incision.

(2) By the Kraske sacral incision, as for excision of the rectum; and

(3) By perineal incision.

This last method has been either (*a*) Zuckerkandl's horseshoe incision, extending across the perineum and in front of the anus, or (*b*) Roux's method.

Discussing these methods, Princess Guedroytz[5] reports that by a series of operations on the cadaver it was found that the first method was difficult; and in the second, the lesion in the bone was a needless complication; and that the third, Roux's method, gave more room, and was accomplished without injury to the levator ani.

She claims that by a comparison of twenty cases collected by different surgeons, Roux's method has afforded the best results, some of his patients being in perfect health from three to six years after operation. This operation as described by Princess Guedroytz, divided into two stages, is as follows:

(1) The testicle is removed, and with it any diseased skin. The vas deferens is separated from the other constituents of the cord, which are ligated and cut, and gentle traction

is made on it until six or seven centimetres have been freed. It is divided obliquely as high up as possible, and the skin incision is closed.

(2) The patient is then placed in the lithotomy position. An incision four inches long and a little more than an inch from the middle line on the left side is made, passing backward by the side of the anus and ending just behind the level of the coccyx. Through this the prostate and anterolateral surface of the rectum are reached easily after dividing some of the anterior fibres of the levator ani. The left index-finger in the rectum then hooks the seminal vesicle downward, and a loop of silk is passed round it as it appears in the bottom of the wound; it is then completely freed by peeling off all surrounding connective tissue with the finger. The vesicle is then brought out together with the remains of the vas, the obliquely cut end of which proves that none has been left behind. The final step is to remove the vesicle by dividing its neck flush with the prostate and suturing the mucosa, the muscular layer, and the surrounding tissue separately. The perineal wound is sutured and a bougie is passed for a few days.

More recently, Dr. Percy Bolton,[6] of New York, has recommended the sacral route, having employed it in a case already the subject of ankylosis of the hip.

During the last few months, yet other cases have been reported, but which, however, I need not here refer to.

The following are, briefly, the notes of my own case, from the report of my House Surgeon, Dr. C. T. Fitzgerald:

F. M., aged twenty-eight years; admitted to the Montreal General Hospital, December 26, 1899, for the relief of a sinus in the right scrotum, the site of a previous incision for removal of the testicle.

The patient was a poorly nourished, anæmic young man of good family history. He had had the left testicle removed in the same hospital, five years ago, by the late Dr. Robert Kirkpatrick, for tuberculous disease. The right was removed ten months ago in England for a recurrence of the disease. The wound had never closed and was discharging freely on admission.

On examination there was evidence of previous cervical adenitis, some thickening in the stump of the right vas, and by rectum a large, hard, nodular mass involving the right seminal vesicle, slightly painful to pressure. There was no other evidence of active tubercular disease.

On January 13, 1900, I removed the remaining portion of the vas and the seminal vesicle, following Roux's method. There was some temperature and a good deal of general disturbance subsequent to the operation, the patient developing a scarlatiniform rash, for which he was isolated. The bladder was washed out for two or three days, and the wound kept open for some time by iodoform gauze.

The patient was discharged from the hospital, February 17. He has since gained in weight, and sailed a week or two ago for England, to take up his former duties, apparently in good health.

The operation was simple until the seminal vesicle was caught up, a prostatic sound being used for this purpose; the dense fibrous tissue attaching the vesicle to the bladder being separated with great difficulty, tiring out my own and my associate's (Dr. Armstrong) fingers before it was severed.

I am indebted to Dr. Wyatt Johnston for the following pathological report:

The examination of the seminal vesicle, received on January 14, 1900, shows to the naked eye a fibrocaseous infiltrating mass which has all the appearances of old-standing tuberculosis, but is free from all acute gray miliary tubercles. This change involves the vessels and portions of vas received.

The cut section has the microscopical appearance of that met with in scrofulous glands. Microscopically, the condition is seen to be one essentially of coagulation necrosis with caseous change, which is also highly suggestive of tuberculous origin. I do not find, however, in any of the sections examined typical giant cells, which certainly would be present if the condition was active.

Microscopical examination failed to reveal any tubercle bacilli; the anatomical condition, though suggestive of tuberculosis, does not supply all the elements necessary for complete proof. The negative results are not at variance with the assumption that it is an old-standing tuberculous lesion.

Unfortunately, the section was not seen until after it had

been treated with formalin solution, thereby preventing the inoculation test, which under the circumstances would have been the only conclusive means of diagnosis to be carried out.

In conclusion, while I hesitate to offer my opinion as against many surgeons of renown who are opposed to the operation, I believe, in this case, the proper course was followed, and that we have removed a possible source of future active tuberculosis in the bladder, or some more remote part of the body.

REFERENCES.

[1] Mansell Moullin: British Medical Journal, March, 1898.

[2] Fuller: Journal of Cutaneous and Genito-Urinary Diseases, October, 1896.

[3] L. Longuet: Traitement Chirurgical de la Tuberculose Genitale chez l'Homme, Revue de Chirurgie, Vol. xx, January, 1900, p. 79.

[4] Ullmann: Centralb. f. Chir., 1890, p. 137. Villeneuve: Congrès de Marseille, 1891. Roux: Congrès français de chirurgie, 1801. Weir: Medical Record, 1895. Schede: Soc. Méd. de Hambourg, 1898. Gueillot: Presse Méd., April 2, 1898. Baudet et Kentdirdjy: Rev. Gen. Gaz. des Hôp., 1898, et Thèse de Dumas, Paris, 1899, No. 29.

[5] Princess Guedroytz: Rev. Méd. de la Suisse Rom., March and April 20, 1899. Abstract Epitome, British Medical Journal, June 24, 1899, p. 98.

[6] Percy Bolton: Journal of Cutaneous and Genito-Urinary Diseases, December, 1899.

A NEW METHOD OF COLPOPLASTY IN A CASE OF ENTIRE ABSENCE OF THE VAGINA.

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In the case of congenital absence of the vagina, should an operation ("Colpoplasty"), which establishes a pocket between the rectum and the bladder simply for sexual purposes, be attempted? It is a very delicate question. The fact that many ingenious attempts made to maintain such an opening have failed, naturally favors the pessimistic views that are held about this operation by many. I felt myself caught in a dilemma when consulted by an attractive young lady, who suffered from the entire absence of vagina, uterus, ovaries, and tubes, and who requested me to create a vagina. Her husband asserted that he would not mind the absence of the sexual organs, could there be only a possibility of intercourse. A previous effort had been made to establish a pocket by simply opening the cellular plane between bladder and rectum, and trying to maintain it by the introduction of tampons; but it had failed completely.

I planned an operation as follows, and carried it out without any apparent difficulties.

After taking the most minute aseptic precautions, a transverse incision was made above the symphysis in the same manner as a transverse suprapubic cystotomy is performed (Fig. 1). To enlarge the peritoneopubic interval, the bladder was distended by the injection of a boracic-acid solution, the catheter being left *in situ* as a guide. The position of Trendelenburg appeared to be the most desirable for the further manipulations.

After dividing the transverse fascia, the prevesical fat

was dissected bluntly between two thumb-forceps. Considering that the peritoneum descends posteriorly between the bladder and rectum, it was naturally pushed upward, and further blunt dissection was done, sticking closely to the interior surface of the symphysis in order to avoid any possible peritoneal injury. For exact localization, the catheter was often pushed forward in the median line. When this blunt dissection had gone so far that a large grooved director, pushed downward in the wound, could be felt from the vulva (Fig. 1), the protruding point was incised laterally from the urethral orifice. Then the connective tissue between rectum and bladder was carefully torn away until the opening was wide enough to permit the introduction of a large forceps.

The second step of the operation consisted in the formation of two skin-flaps, as indicated on the right of Fig. 2. Their base was represented by the labia; their length was sufficient to draw them through the newly-formed canal and fasten them above the symphysis. The left side of Fig. 2 shows the flap turned inwardly and the remaining gap united. The tip of the flap of each side was seized with a forceps introduced through the suprapubic opening (Fig. 1) and pulled up and fastened to the subcutaneous tissue there. Now the incision above the symphysis was united with a subcutaneous row of catgut sutures, two relaxation sutures, consisting of iodoform silk, being applied above.

The flaps were so situated that their wound surfaces were pressed against the walls of the new canal, while their skin surfaces faced each other. They were kept asunder by the introduction of a tampon of iodoform gauze. It is evident that no agglutination of the flaps could take place, thus guaranteeing the maintenance of the vaginal canal.

The gaps extending from the inner side of the labia to the thigh, as indicated on Fig. 2, were united on general principles after the flaps had been reverted at their bases; their protection consisting in an iodoform collodion dressing. The suprapubic wound was covered with a dressing which exerted considerable pressure.

With the exception of repeated disturbances in micturition and partial suppuration of the stitch-canals, recovery was uninterrupted. As far as could be ascertained one year after the operation, there was only slight shrinkage, but the canal was still ample, giving perfect gratification to the mated couple.

TETANUS.[1]

A STUDY OF THE NATURE, EXCITANT, LESIONS, SYMPTOMATOLOGY, AND TREATMENT OF THE DISEASE, WITH A CRITICAL SUMMARY OF THE RESULTS OF SERUM THERAPY.

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(CONCLUDED FROM PAGE 445.)

CASES TREATED BY INTRACEREBRAL INJECTIONS.

No. 1.—*Name,* Chaufard and Quenu.[297] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of finger. *Period of incubation,* fourteen days. *Day of first injection,* third day. *Method of administration,* intracerebral. *Amount,* 4 cubic centimetres and 130 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says absolutely no harm was done by the intracerebral injections, bearing out the experiments of Roux and Borrel on guinea-pigs.

No. 2.—*Name,* Garnier.[298] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* varicose ulcer of leg. *Period of incubation,* unknown. *Day of first injection,* fourth day. *Method of administration,* intracerebral. *Amount,* 6 cubic centimetres = 15 cubic centimetres, also 30 cubic centimetres intravenously and 80 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* chloral. *Result,* recovery. *Remarks.* Author says apparently a mild case in the beginning, but became bad later on. The intracerebral injections did no harm.

No. 3.—*Name,* Robert.[299] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* wound of palm, caused by a piece of bone. *Period of incubation,* unknown. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 7 cubic centimetres = 14 cubic

[1] Read at the meeting of the New York County Medical Society, April 23, 1900.

centimetres and 40 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* not stated. *Result,* death. *Remarks.* According to author, a very bad case.

No. 4.—*Name,* Ombredanne.[300] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* excoriation over knee. *Period of incubation,* nine days. *Day of first injection,* fifth day. *Method of administration,* intracerebral. *Amount,* 7 cubic centimetres = 14 cubic centimetres and 60 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* 2.0 chloral. *Result,* recovery. *Remarks.* Only 2.0 of chloral, and author, with some justification, argues that recovery was due entirely to the antitoxin.

No. 5.—*Name,* Heckel and Reynes.[301] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* scratch injury, caused by a nail. *Period of incubation,* about seven days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* 6 cubic centimetres = 12 cubic centimetres and 40 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* not stated. *Result,* death. *Remarks.* Autopsy showed not even a trace of meningitis; and author says this failure should not speak against Roux and Borrel's method.

No. 6.—*Name,* Delmas.[302] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of forearm. *Period of incubation,* seven days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* not stated and 20 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* chloral and KBr. *Result,* death.

No. 7.—*Name,* Bacaloglu.[303] *Year,* 1898. *Diagnosis,* Tetanus (?). *Nature of injury,* cause not discovered. *Period of incubation,* unknown. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 5 cubic centimetres = 14 cubic centimetres and 40 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* chloral. *Result,* death.

No. 8.—*Name,* Du Hamel.[304] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* gunshot wound of hand. *Period of incubation,* about twelve days. *Day of first injection,* first day. *Method of administration,* intracerebral and subcutaneous. *Amount,* 6 cubic centimetres strong. *Make,* Roux. *Result,* recovery.

No. 9.—*Name,* Hue.[305] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of radius; sepsis. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 6 cubic centimetres strong and 20 cubic centimetres subcutaneously. *Make,* Roux. *Other treatment,* not stated. *Result,* death.

No. 10.—*Name,* Rambaud.[306] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* laparotomy for uterine fibroid. *Period of incubation,* ten days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 750 cubic centimetres, also 50 cubic centimetres intravenously and 6 cubic centimetres strong intracerebrally. *Make,* not stated. *Other treatment,* not stated. *Result,* recovery, but the patient

died ten days after the disappearance of all tetanus symptoms. *Remarks.* Tetanus bacilli found in the laparotomy wound. No autopsy permitted.

No. 11.—*Name,* Rambaud.[306] *Year,* 1868. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* accidental amputation of thumb by a hatchet. *Period of incubation,* seven days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* not stated. *Make,* not stated. *Other treatment,* not stated. *Result,* death. *Remarks.* Death eleven hours after injection.

No. 12.—*Name,* Church.[307] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* extensive laceration of leg. *Period of incubation,* twelve days. *Day of first injection,* seventh day. *Method of administration,* subcutaneous. *Amount,* about 375 cubic centimetres, also 25 cubic centimetres intravenously and about 120 minims. *Make,* Gibier. *Other treatment,* chloral, morphine, antistreptococcus serum, etc. *Result,* recovery. *Remarks.* Tetanus bacilli found in the wound.

No. 13.—*Name,* Follet.[308] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of foot, caused by wagon wheel. *Period of incubation,* eleven days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* 10 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* various remedies. *Result,* death. *Remarks.* Autopsy of brain absolutely negative.

No. 14.—*Name,* Routier.[309] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contused wound of palm. *Period of incubation,* ten days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* 8 cubic centimetres = 16 cubic centimetres and 100 cubic centimetres subcutaneously. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* death.

No. 15.—*Name,* Bousquet.[310] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of foot. *Period of incubation,* seven days. *Day of first injection,* fourth day. *Method of administration,* intracerebral. *Amount,* not stated. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* death. *Remarks.* Death ten hours after injection; very bad case.

No. 16.—*Name,* Beurnier.[311] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* intracerebral. *Amount,* 8 cubic centimetres, also subcutaneously. *Make,* Paris Institute Pasteur. *Other treatment,* chloral and morphine. *Result,* death. *Remarks.* Only a short reference found.

No. 17.—*Name,* Baudomont.[312] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* not stated. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* intracerebral. *Amount,* 5 cubic centimetres. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 18.—*Name,* Forgue and Roger.[313] *Year,* 1898. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of finger. *Period of incubation,* about one month. *Day of first injection,* fourth day. *Method of administration,* subcutaneous. *Amount,* 110 cubic centimetres and 13

cubic centimetres intracerebrally. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromides, morphine. *Result,* recovery. *Remarks.* Evidently a very grave case in spite of long period of incubation.

No. 19.—*Name,* v. Leyden.[214] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Period of incubation,* ten days. *Day of first injection,* first day. *Method of administration,* subdural. *Amount,* 4.0 and 5.0 subcutaneously. *Make,* Behring and Tizzoni. *Other treatment,* chloral, morphine. *Result,* recovery.

No. 20.—*Name,* Semple.[215] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contusion of testes, no visible wound. *Period of incubation,* three days(?). *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 5 cubic centimetres = 10 cubic centimetres and 60 cubic centimetres subcutaneously. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Remarkable inasmuch as there was no visible wound to be found.

No. 21.—*Name,* Cuthbert.[216] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of leg. *Period of incubation,* ten days. *Day of first injection,* fourth day. *Method of administration,* intracerebral. *Amount,* 5.0 = 10.0 and 30 cubic centimetres subcutaneously. *Make,* Paris Institute Pasteur. *Other treatment,* morphine. *Result,* death.

No. 22.—*Name,* Lawrence.[217] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of wound,* gunshot wound of foot. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 5.0 and 50 cubic centimetres subcutaneously. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, morphine, KBr, Baccelli. *Result,* recovery. *Remarks.* Author believes that the subcutaneous injections were useless, and regrets the weakness of the antitoxin. He does not place much value upon the carbolic acid injections.

No. 23.—*Name,* Gibb.[218] [219] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed injury of hand, with subsequent gangrene. *Period of incubation,* seventeen days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* about 71 cubic centimetres and 104 cubic centimetres subcutaneously. *Make,* Paris Institute Pasteur. *Other treatment,* chloral. *Result,* recovery(?), death(?). *Remarks.* See foot-note.[1]

[1] After making general remarks about the treatment of tetanus, the author concludes as follows: The unusually large intracerebral doses of serum were given on account of the intense severity of the symptoms. Apart from a scarlatina form rash over the abdomen lasting three days the injections produced no ill effect. *There was no sepsis.* In a subsequent communication, the author reports the death of this patient more than eight weeeks after the last intracerebral injection, and says that the result of post-mortem examination leaves but little doubt that the fatal termination was directly due to the particular method of the injection. Clinically, symptoms of a cerebral abscess were noted; not operated, and patient died. Post mortem an abscess-cavity was found in each frontal lobe, with pus in the lateral ventricles and around the cerebellum; bac-

No. 24.—*Name,* A. Kocher.[320] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* Punctured wound of toe, caused by a nail. *Period of incubation,* fifteen days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* 10 cubic centimetres and 90 cubic centimetres intravenously. *Make,* not stated. *Other treatment,* chloral, morphine. *Result,* recovery. *Remarks.* Author says evidently a mild case.

No. 25.—*Name,* Leed's Infirmary.[321] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* penetrating wound of foot. *Period of incubation,* five days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* 30 cubic centimetres and 15 cubic centimetres subcutaneously. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 26.—*Name,* Collier.[322] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of thumb. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 10 cubic centimetres and 30 cubic centimetres subcutaneously. *Make,* Roux and British Institute of Preventive Medicine. *Other treatment,* chloral. *Result,* recovery.

No. 27.—*Name,* Gimlette.[323] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of finger. *Period of incubation,* one week. *Day of first injection,* third day. *Method of administration,* intracerebral. *Amount,* 5 cubic centimetres strong and 200 cubic centimetres subcutaneously. *Make,* not stated. *Other treatment,* KBr, chloral, morphine, hyoscyamus. *Result,* recovery. *Remarks.* Author says that but for the serum the patient would inevitably have died.

No. 28.—*Name,* Schuster.[324] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* contusion of face. *Period of incubation,* not stated. *Day of first injection,* not stated. *Method of administration,* subdural. *Amount,* 4.0. *Make,* Tizzoni. *Other treatment,* not stated. *Result,* recovery. *Remarks.* Author says that absolutely no harm was done by intracerebral injection.

teriologically, the staphylococcus pyogenes aureus was found. Author finally remarks as follows: "Every care was taken to secure asepsis while drilling the skull and injecting the serum; the drill and needle were always boiled before use, and as sepsis was not at any time observed clinically, it seems to me difficult to believe that the source of infection was introduced with the serum; but whatever may have been the exciting cause of the sepsis, damage to the brain from the '*repeated*' (italics mine) injections would unquestionably predispose to it." In this case repeated injections were risked on account of the excessive severity of the symptoms, probably, however, it is unsafe to venture a repetition of the process in any case." It is evident to me that the infection was due to insufficient asepsis. It is difficult to make injections repeatedly aseptically, as we always have to penetrate granulation tissue, which is hardly ever surgically clean; furthermore, the finding of the staphylococcus pyogenes aureus is corroborative of the fact that the infection was from the skin.

No. 29.—*Name,* Marchand.[325] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* crushed and lacerated wound over occiput. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 5 cubic centimetres. *Make,* Roux. *Other treatment,* KBr, chloral, morphine, and 110 cubic centimetres subcutaneously. *Result,* death. *Remarks.* Author thinks that the injections were made too late; he also says that the subcutaneous injections had no effect whatever.

No. 30.—*Name,* Pitha.[326] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* low forceps delivery, incision and suture of perineum. *Period of incubation,* five days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 2.0 and 20.0, subcutaneously. *Make,* Roux. *Other treatment,* morphine. *Result,* death.

No. 31.—*Name,* Pitha.[326] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* abortion. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 2.0 and 270 subcutaneously. *Make,* Bujwid and Roux. *Other treatment,* morphine. *Result,* death. *Remarks.* Tetanus bacilli found in extirpated uterus.

No. 32.— *Name,* Pitha.[326] *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* manual extraction of placenta. *Period of incubation,* nine days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 5.0 and 10.0 subcutaneously. *Make,* Roux. *Other treatment,* morphine. *Result,* death.

No. 32.—*Name,* Pitha.[326] (Rubeska). *Year,* 1899. *Diagnosis,* Tetanus puerperalis. *Nature of injury,* forceps delivery and suture of perineum. *Period of incubation,* five days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 4.0 and 20.0 subcutaneously. *Make,* Roux. *Other treatment,* morphine, chloral. *Result,* death. *Remarks.* Tetanus bacilli found in the perineal wound, but not in the extirpated uterus.

No. 34.—*Name,* Tavel.[327] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of patella, with opening of joint. *Period of incubation,* eleven days. *Day of first injection,* first day. *Method of administration,* intravenous. *Amount,* 50 cubic centimetres, also 6 cubic centimetres intracerebrally and 40 cubic centimetres subcutaneously. *Make,* Tavel. *Other treatment,* not stated. *Result,* recovery.

No. 35.—*Name,* Tavel.[327] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* injury of foot, caused by nail. *Period of incubation,* seventeen days. *Day of first injection,* fifth day. *Method of administration,* intracerebral. *Amount,* 10 cubic centimetres and 90 cubic centimetres intravenously. *Make,* Tavel. *Other treatment,* chloral. *Result,* recovery.

No. 36.—*Name,* Julliard.[328] *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* gunshot wound of thigh. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount* 4 cubic centimetres. *Make,* not stated. *Other treatment,* not stated. *Result,* death.

No. 37.—*Name,* Nimier. *Year,* 1899. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* compound fracture of forearm. *Period of incubation,* eighteen days. *Day of first injection,* first day. *Method of administration,* subcutaneous. *Amount,* 110 cubic centimetres and 4 cubic centimetres intracerebrally. *Make,* Paris Institute Pasteur. *Other treatment,* not stated. *Result,* death.

No. 38.—*Name,* Johnson.[329] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* scratch injury of forearm. *Period of incubation,* six days. *Day of first injection,* second day. *Method of administration,* subcutaneous. *Amount,* 490 cubic centimetres and 10 cubic centimetres intracerebrally. *Make,* Parke, Davis & Co. *Other treatment,* chloral, NaBr. *Result,* recovery. *Remarks.* Author says, "No sudden curative effect of the antitoxin was to be observed; nor does it seem that any argument for or against the intracerebral injections is to be drawn from this case." No ill effect was attributed to its use.

No. 39.—*Name,* Rogers.[330] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* pistol-shot wound. *Period of incubation,* eighteen days. *Day of first injection,* not stated. *Method of administration,* intracerebral. *Amount,* 2 vials. *Make,* New York Board of Health. *Other treatment,* not stated. *Result,* death.

No. 40.—*Name,* Kocher.[331] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of scalp. *Period of incubation,* seventeen days. *Day of first injection,* sixteenth day. *Method of administration,* intracerebral. *Amount,* 10 cubic centimetres and 80 cubic centimetres intravenously. *Make,* Bernese make. *Other treatment,* chloral, morphine, Baccelli. *Result,* recovery.

No. 41.—*Name,* Kocher.[331] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* lacerated wound of eyelid. *Period of incubation,* six days. *Day of first injection,* first day. *Method of administration,* intracerebral. *Amount,* 10 cubic centimetres. *Make,* Bernese make. *Other treatment,* chloral, morphine. *Result,* death. *Remarks.* Tetanus bacilli found in the wound. No injury of brain found at autopsy.

No. 42.—*Name,* Laplace.[332] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by a rusty nail. *Period of incubation,* ten days. *Day of first injection,* fifth day. *Method of administration,* subdural in head. *Amount,* 60 cubic centimetres. *Make,* Paris Institute Pasteur. *Other treatment,* Baccelli. *Result,* recovery.

No. 43.—*Name,* Abbe.[333] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of palm. *Period of incubation,* seven days. *Day of first injection,* second day. *Method of administration,* intracerebral. *Amount,* 6.0 twice, and subcutaneously amount not stated. *Make,* New York Board of Health and Parke, Davis & Co. *Other treatment,* morphine, chloral, KBr. *Result,* recovery. *Remarks.* Case was complicated by a pneumonia.

No. 44.—*Name,* Abbe.[333] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of palm. *Period of incubation,* eight days. *Day of first injection,* first day. *Method of administration,*

intracerebral. *Amount,* 3 cubic centimetres and 57 cubic centimetres New York Board of Health and Parke, Davis & Co. *Other treatment,* chloral and bromides. *Result,* death. *Remarks.* Author says this case was of a severe type. Though it was injected promptly, no benefit was shown from the operation.

No. 45.—*Name,* Abbe.[333] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of hip. *Period of incubation,* nine days. *Day of first injection,* fifth day. *Method of administration,* intracerebral. *Amount,* 6 cubic centimetres and subcutaneously exact amount not stated. *Make,* Parke, Davis & Co. *Other treatment,* chloral, bromides. *Result,* recovery. *Remarks.* In this case improvement was noted soon after the first injection, and continued until recovery. The injection was done under cocaine and was well borne.

No. 46.—*Name,* Abbe.[333] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of finger. *Period of incubation,* sixteen days. *Day of first injection,* twelfth day(?). *Method of administration,* intracerebral. *Amount,* 8 cubic centimetres, and subcutaneously exact amount not stated. *Make,* Parke, Davis & Co. *Other treatment,* chloral, bromides, morphine. *Result,* death. *Remarks.* Author says no benefit was derived from the operation; but it was a bad case, and brought too late to the hospital.

No. 47.—*Name,* Abbe.[333] *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* punctured wound of foot, caused by a nail. *Period of incubation,* nineteen days. *Day of first injection,* third day. *Method of administration,* subcutaneous. *Amount,* exact amount not stated, and 6 cubic centimetres intracerebrally. *Make,* Parke, Davis & Co. *Other treatment,* bromides. *Result,* recovery.

No. 48.—*Name,* Moschcowitz. *Year,* 1900. *Diagnosis,* Tetanus traumaticus. *Nature of injury,* toy-pistol injury of palm. *Period of incubation,* seven days. *Day of first injection,* first day. *Method of administration,* intravenous. *Amount,* 30 cubic centimetres and 5 cubic centimetres intracerebrally. *Make,* Paris Institute Pasteur. *Other treatment,* chloral, bromides, morphine. *Result,* death.[1]

Of 1 case with a period of incubation of 3 days, 1 recovered and 0 died, 0 per cent; of 3 cases with a period of incubation of 5 days, 0 recovered and 3 died, 100 per cent.; of 4 cases with a period of incubation of 6 days, 1 recovered and 3 died, 75 per cent.; of 8 cases with a period of incubation of 7 days, 2 recovered and 6 died, 75 per cent.; of 1 case with a period of incubation of 8 days, 0 recovered and 1 died, 100 per cent.; of 6 cases with a period of incubation of 9 days, 4 recovered and 2 died, 33.33 per cent.; of 5 cases with a period

[1] As this article was finished and ready for publication on April 20, 1900, the cases published subsequent to that date are not enumerated.

of incubation of 10 days, 3 recovered and 2 died, 40 per cent.; of 2 cases with a period of incubation of 11 days, 1 recovered and 1 died, 50 per cent.; of 2 cases with a period of incubation of 12 days, 2 recovered and 0 died, 0 per cent.; of 1 case with a period of incubation of 14 days, 1 recovered and 0 died, 0 per cent.; of 1 case with a period of incubation of 15 days, 1 recovered and 0 died, 0 per cent.; of 1 case with a period of incubation of 16 days, 0 recovered and 1 died, 100 per cent.; of 3 cases with a period of incubation of 17 days, 3 recovered and 0 died, 0 per cent.; of 2 cases with a period of incubation of 18 days, 0 recovered and 2 died, 100 per cent.; of 1 case with a period of incubation of 19 days, 1 recovered and 0 died, 0 per cent.; of 1 case with a period of incubation of 1 month, 1 recovered and 0 died, 0 per cent.; of 3 cases in which period of incubation is not stated, 1 recovered and 2 died, 66.66 per cent.; of 3 cases in which period of incubation is not known, 1 recovered and 2 died, 66.66 per cent.

On concentrating these intracerebral cases, according to the usually published statistics, we get following values:

Of 4 cases with a period of incubation under 5 days, 1 recovered and 3 died, 75 per cent.; of 24 cases with a period of incubation from 5-10 days, 10 recovered and 14 died, 58.33 per cent.; of 6 cases with a period of incubation from 10-15 days, 5 recovered and 1 died, 16.66 per cent.; of 8 cases with a period of incubation over 15 days, 5 recovered and 3 died, 37.5 per cent.; of 6 cases in which incubation period is not given or unknown, 2 recovered and 4 died, 66.66 per cent.

From these two lists it will readily be seen that I have been able to find in the literature reported 338 cases, treated in one way or another with antitoxin; of these 338 cases, 196 were followed by recovery and 142 were followed by death, or a mortality percentage of 42.01.[1]

Regarding the second point, *i.e.*, the rapidity of development of the symptoms, we do well to divide tetanus, according

[1] It should be noted, however, that it is certain that a much larger proportion of the recoveries from tetanus are published than of the fatalities, so that the above mortality percentage should be taken with much allowance.—EDITOR.

to Rotter,[89] into following subdivisions. Naturally, however, we must always take into consideration the important factor that in the decision of the case a great deal depends upon the personal judgment of the observer, and possibly no two observers would agree upon the class into which a case is to be placed.

(*a*) Very grave cases are those in which in the course of a few hours, or one or two days, the muscles of the entire body are involved in the highest degree; these cases give an absolutely bad prognosis.

(*b*) Grave cases; in these the tetanic symptoms may set in just as acutely as in the preceding class, but the continuous contractions of the muscles alternate with onsets of clonic and tonic convulsions; many of these cases die during these attacks of disturbances of circulation or respiration (spasm of the glottis), or they die more gradually of loss of strength.

(*c*) Medium grave cases; in these the tetanic symptoms develop in the course of from a few hours or days to six to eight weeks; then the spasms gradually disappear, while at the same time the individual attacks become more mild and diminish in frequency.

(*d*) Mild cases; these are distinguished by the fact that the symptoms come on very gradually, quite frequently with a prodromal period of a number of days, during which the patients complain only of pain, drawing, and an uncertain rigidity in the muscles. Recovery in these cases is quite frequent.

(*e*) Finally, very mild cases; in which there is only a mild trismus and rigidity of the muscles of the neck; these cases are scarcely ever fatal, though the symptoms may last even through many weeks.

Treatment.—Up to within the last decade the treatment of tetanus was entirely symptomatic; there was no rationale, and, for that matter, there could not have been any before the discovery of Tizzoni and Cattani, and Behring. The treatment up to that time had merely the one object in view, to overcome the most apparent and most distressing symptoms,

i.e., the spasms and contractions. Since the discovery of the tetanus bacillus and its toxins, and the mode of their action, the treatment has been modified to a great extent; hence, at the present date a rational treatment of tetanus would have to include the following points:

(1) To destroy the bacteria at the seat of infection and thereby prevent a further production of toxins.

(2) To eliminate from the body the toxins already absorbed from the primary lesion.

(3) To neutralize and render innocuous the poison already absorbed.

(4) To immunize the body after local infection has taken place.

(5) To overcome the symptoms induced by the action of the toxins.

1. To destroy the bacteria at the seat of infection, and thereby prevent a further production of toxins. As already stated, and found by the experiments of Kitasato, Rosenbach, and others, the bacilli of tetanus in the greatest majority of cases remain confined to the point of infection, and are not spread throughout the system; hence it is important to proceed at once surgically, to enlarge the wound and remove all foreign matter. Too much stress cannot be laid upon this point, and yet it is so self-apparent that it is and should be a *sine qua non* to every mind with the least bit of surgical training. Tetanus germs are practically found everywhere, and are so frequently carried into small wounds by bits of wood, earth, and in this country with the inevitable paper wad of the fourth of July toy-pistol, that I am fairly confident that its prompt removal alone would in many instances prevent the occurrence of tetanus. A large experience during several years at one of the largest public dispensaries of New York City has, however, led me to the belief that this first surgical rule is very frequently neglected, as I have had opportunity to remove on many occasions the bits of cartridge-wad from patients who had been under a physician's treatment before coming to the dispensary.

After removing the offending foreign body, the next step should be a thorough disinfection of the wound. This has for its object, however, not only the destruction of the tetanus bacilli, which, in their resting spore form, the form in which they most probably occur in wounds, is a most difficult thing to do, requiring long exposure to very concentrated antiseptics; but the disinfection certainly does away with the other saprophytic and pyogenic germs. It may appear trivial at first sight even to take saprophytic germs into consideration when dealing with another so virulent an infection as tetanus; but in reality it is a very important consideration, as we have learned from the experiments of Vaillard and Rouget [56] that nothing is better for the development of the tetanus germs than the co-existence of other micro-organisms.

Many disinfecting agents have been recommended; it is comparatively easy to kill the saprophytic germs, but, as it should be our aim to destroy also the tetanus bacilli, we should resort to antiseptics which are in a measure also active on the spores of the tetanus germs. Of the most frequently used and recommended as active are: (*a*) 1:1000 bichloride of mercury solution to which has been added 5 per cent. tartaric acid or 0.5 per cent. hydrochloric acid; (*b*) 2 per cent. carbolic acid solution; (*c*) 1 per cent. Kresol solution. (*d*) Sahli [57] recommends very highly tinctured iodine which contains 1 or 2 per cent. terchloride of iodine. Stronger and more sure is the cauterization of the entire wound, either with the actual cautery or with a strong solution of nitrate of silver.

The question of amputation of the injured member, if possible, should also be taken into consideration. Opinions differ very widely regarding this point; the most generally accepted opinion, however, reserves for amputation only those cases in which, in consequence of complicated and very dirty wounds, a thorough disinfection is impossible by other means; in other words, each case is governed by the general surgical rules applicable to injuries. I doubt whether anybody would amputate even a toe or a finger before any symptoms of tetanus arose.

2. To eliminate from the body the toxins already absorbed from the source of infection. It has not as yet been definitely decided through which channels the tetanus toxins are eliminated from the system. The main channel appears to be with the urinary secretion, although the experiences of various observers are still conflicting; Brunner (*loc. cit.*), Blumenthal,[58] Bruschettini,[59] taking opposite sides; the toxins have surely been found in the lacteal secretions of animals; they have not been found in the bile; and nobody has as yet succeeded in finding toxins in the perspiration. In spite of the conflicting observations, however, by analogy with other intoxications, we are justified in utilizing known methods of depletion, as diuresis, catharsis, and diaphoresis. The latter is hardly ever indicated by artificial measures, as excessive perspiration is one of the marked symptoms of tetanus.

Although I have not been able to find any reference to it in the literature at my command, one method of depletion appears to me to have a great deal to commend it; and I believe it is certainly worthy of trial, provided the condition of the patient is such as to warrant it. I base this recommendation not upon personal experience, but more upon the theoretical ground that at least in animal experiments the blood was nearly always found to contain the toxins; it may be well to perform venesection, withdraw a certain quantity of blood, and substitute for it normal saline solution.

3. To neutralize and render innocuous the poison already absorbed. This has for its fundamental principle the treatment by means of introducing into the system the serum of animals which have been rendered immune to the disease.

Behring, Tizzoni and Cattani, and Kitasato through numerous interesting experiments found that it is possible to immunize certain animals against fatal doses of the toxins, by introducing into their system hypodermatically either attenuated toxins in augmenting doses, or attenuated pure cultures of the tetanus bacillus. The blood serum of an animal immunized in this manner contains the specific antitoxin, and was found to give immunity against the specific disease to

other animals. This immunizing power is quantitatively proportionate to the amount of antitoxin present in the serum. From their interesting experiments it was also found that it is not only possible to immunize animals against infections which are to follow the immunization, but also that it is possible to avert a fatal termination in cases of infection, provided an injection of serum containing this antitoxin is made within a reasonable time; in other words, the serum of immunized animals has not only an immunizing power for healthy animals, but also a curative power in already diseased or infected animals.

The mode of action of the antitoxin, however, has not yet been acceptably explained. Some observers, as Behring and Kitasato,[60] Sahli (*loc. cit.*), and others, look upon its action as a chemical one, and base their view upon the fact that when toxins are mixed in a test-tube with the proportionately required amount of antitoxin, and if this mixture is then injected into animals to which this dose of the toxins is fatal, no tetanus arises.[1] From this experiment Behring argues that, theoretically at least, all cases of tetanus are curable, provided that a sufficient amount of antitoxin in sufficient concentration is introduced into the system to neutralize the toxins within the body. As a matter of fact, however, this theory is not based upon sufficient foundation, as the following objections might, and justly, be adduced against it; first, that we deal in the living body with conditions which materially differ from the test-tube; and, secondly, that we have seen that in the living body the toxins are fixed more or less permanently into the motor cells of the spinal cord. But, finally, Buchner [61] [62] [63] has experimentally proven the fallacy of the above theories. He came to the conclusion by noting a difference in reaction which he obtained by injecting into animals various mixtures of toxin and antitoxin. He found that the two substances do not influence each other directly in a chemi-

[1] A somewhat similar result was obtained by Calmette in his experiments with snake poison; snake poison mixed in a test-tube with the proportionate amount of antivenin, and injected into rabbits failed to produce death.

cal light, and that there does not occur a neutralization of the toxins by the antitoxins; but that both substances act only through the medium of the living body, *i.e.*, that both have a special influence upon the living organism, but in an antagonistic manner. Buchner claims that the cells already affected cannot be freed from their inherent poison, but looks upon the curative power of the antitoxin (which he does not deny) merely as an immunizing action upon such cell territories, which up to the introduction of the antitoxin into the body, have not yet been affected by the tetanus poison; so that these unaffected cells do not respond to the destructive agency of the toxins.

The latest theory regarding the action of the antitoxin is named by its proposer, Ehrlich,[334] the "side-chain" (Seitenketten) theory; and many observations have been published in support of it by Knorr,[335] Wassermann and Takaki (*loc. cit.*), Cobbet,[336] and others; though others, Buchner in particular, do not give much credence to it, and claim that it is too fanciful. To my mind it is exceedingly difficult to understand and much more difficult to explain in few words; essentially it means the following: There exists in every cell (in the case of tetanus they are the cells of the brain and spinal cord) a certain substance which renders these cells susceptible to a certain poison; but the possession of this substance gives also the power to the cell to produce the corresponding antitoxin. In other words, that portion of the cell protoplasm which has the power to combine with a given toxin Ehrlich calls the "Seitenkette" (side-chain), and, when so combined, liberates from the cell an antitoxin which is thrown into the circulation, and may be collected there. From a chemical point of view the term "Seitenkette" is identical with antitoxin.

No matter which theory regarding the action of the antitoxin is accepted as the true one, all that can be positively accepted as proven regarding its value to this point may be briefly stated in the following:

(*a*) It is possible to immunize animals by injections of attenuated toxins or attenuated cultures.

(*b*) The blood serum of such immunized animals will prevent the outbreak of tetanus in animals which are to be infected.

(*c*) The blood serum of such immunized animals can cure already infected animals, provided it is injected sufficiently early and in sufficient amount and concentration.

This can be done practically in all cases of experimental tetanus in animals. However, if we attempt to transfer and compare these results with tetanus in the human being, though we do certainly find some improvement in the statistics, it is still not to that marked degree which we should expect to find. The question arises, therefore, to what cause or causes is this difference due? It is my own personal opinion, which appears to be corroborated by the careful reading of the 338 cases commented upon in my list, that the principal cause of failure lies in our defective powers to diagnosticate tetanus sufficiently early. When we *can* make the diagnosis of tetanus, the destructive process in the spinal cord has gone on to such a degree that a complete *restitutio ad integrum* is almost an impossibility; or, as Marchand [64] so tersely says, "The patient with tetanic symptoms is not beginning to have tetanus; but is beginning to die of tetanus."

As a matter of fact, our efforts in the treatment of tetanus, when our present knowledge of the pathological anatomy is taken into consideration, should aim at the following points:

(*a*) To neutralize the toxins circulating in the body;

(*b*) To prevent their toxic effect on hitherto unaffected parts;

(*c*) To withdraw the toxins from affected cell territories.

The experiments of Kitasato and Behring (*loc. cit.*) show that with a properly executed and timely treatment with antitoxin we can do justice to the first requirement, and if we consider Buchner's hypothesis as correct, we will also fulfil the second requirement, but regarding the third point there still exists considerable doubt.

The experiments of Blumenthal (*loc. cit.*) have proven that when tetanus patients were treated with antitoxin, the blood of these patients has lost its poisonous properties; but, in spite of this beneficial action, many patients still died; this could not but lead to one conclusion, namely, that the toxins have already accumulated in one particular part, *i.e.*, the spinal cord, in sufficient amount to bring on a fatal termination. This proposition was also proven when the blood from a patient treated with antitoxin injected into mice gave rise to no tetanic symptoms, while bits of the spinal cord implanted into mice were always followed by unmistakable tetanus.

The solution of this problem therefore reduced itself to the question of our ability to introduce the antitoxin into those parts where the principal pathological lesions are found (the higher nerve centres), *i.e.*, into absolute proximity, if not actual contact, with the toxins themselves.

To do justice, also, to this question, Roux and Borrel [65] evolved the intracerebral method, and have certainly demonstrated its efficacy in animal experiments. Roux and Borrel infected forty-five guinea-pigs with tetanus, and subsequently treated them by trephining and injecting the antitoxin directly into the brain, and in this manner succeeded in saving thirty-five; while of seventeen others treated only with subcutaneous injections, only two survived; and of a further seventeen control animals, which received no treatment whatsoever, all died. The experiments of Roux and Borrel are based upon the fact that when a portion of brain substance is crushed and intimately mixed with some tetanus toxins, and this resulting mixture is then centrifugalized, it separates into two layers; the upper layer is an opalescent liquid, while the lower stratum is the nerve substance. Further research has demonstrated the fact that the upper layer contained very little or none of the toxins; while the lower or nervous substance contained all or nearly all of the toxins. Now, while these experiments go to prove merely the intimate relationship between nerve cells and toxins, it gave an impetus to their experiments, of trephining and introducing the antitoxin directly into the brain sub-

stance. The question naturally arises, Can we expect that the relatively small amount of antitoxin which we can inject into the cerebral hemispheres will become diffused sufficiently rapidly, so as to bring it into intimate contact and relation with the toxins fixed in the affected cells?

Independently of Roux and Borrel, Blumenthal and Jacob [66] saw the importance of bringing into intimate relation the antitoxin with the toxins; in other words, to introduce the antitoxin directly into the spinal cord, and in this manner evolved the subdural method as reported by Jacob.[67] Their experiments were executed on tetanized goats, which were treated at once upon the outbreak of the tetanus symptoms with subdural injections of antitoxin into the spine, but all of the animals died. They have also repeated the experiments of Roux and Borrel, but not with the almost uniformly good results which these observers have obtained. As a result of their experiments, they come to the conclusion that at the outbreak of the series of symptoms, which we designate collectively as tetanus, the tetanic poison is already so firmly fixed in the central nervous system that it is impossible to remove it therefrom, even with the aid of subdural injections; and they feel themselves obliged to warn against a too sanguine expectation of Roux and Borrel's method. It is evident, even from this short explanation, that this point of the treatment is not by any means closed, and requires further elucidation.

A research into the statistics may help us in clearing up the value of this method; but, just as is the case with statistics usually, there is always the personal equation to be contended with. No one can say whether the cases so far reported would not have done equally as well with subcutaneous injections alone. Another point which must not be overlooked, is that personal pride and human nature impel us rather to report our successes, than our failures.

To many it may very properly appear to be no trivial matter to inject three cubic centimetres or more of a foreign liquid into so important an organ as the brain. I must confess I have carried out the injection in my patient on this account

with a great amount of hesitation, and only after due deliberation. It should also not be forgotten that the fluid is injected into the comparatively unimportant anterior lobes. A revision of the cases reported regarding this point might be of some importance. In the cases reported as cured, the opinion appears to be unanimous that the injections were well borne, and were not productive of the least harm; while in the cases with a fatal termination, and upon which an autopsy was permitted, the investigation revealed no gross injury.

In Roberts's case (No. 3) the autopsy showed around the trephine opening a slight subcutaneous hæmorrhage. On the right side there was found in the pia mater an ecchymosis about the size of a pinhead, and a trifle larger one on the left side. On removing the meninges, there were found on both sides of the brain two pinpoint pricks which were almost imperceptible. On incising the brain, there was found on the left side an insignificant channel of about the diameter of a needle; while on the right side there existed a subcortical cavity about the size of a hazel-nut, which was filled with liquid blood, its walls were soft and covered with a hæmorrhagic exudate.

In Heckel and Reynes's case (No. 5) the autopsy showed no trace of meningitis; while of the punctures hardly a visible trace remained.

In Delmas's case (No. 6) the autopsy showed on the right side an abundant hæmorrhagic prick, and on the left side a cavity about the size of a small pea filled with blood.

Gibbs's case (No. 23) would to a great measure speak for the danger of intracerebral injections, but, on careful consideration, it is readily seen that too much importance should not be attached to it; the case was merely one of sepsis, caused not so much by the injection, as recommended by Roux and Borrel, but more probably through one of the later injections, through more or less infected granulation tissue. (See also remarks in the report of the case.)

In Pithas's case (No. 31) the autopsy showed on the right side of the brain merely the puncture wound, with slight hæmorrhage around it, and in addition on the left side the same state and also a small cyst containing a little bloody serum, caused by a crushing of the corresponding portion of the brain.

In Pithas's case (No. 33) the autopsy showed on the right side of the brain, along the channel of the needle, a few punctate hæmorrhages; on the left side there was found a cyst the size of a hazel-nut, which contained some perfectly sterile fibrin flakes; in the wall of the cyst punctate hæmorrhages.

Dr. Mandlebaum was good enough to examine that portion of the brain, of my case, where the injection was carried out, and found only the slight channel, where the needle penetrated, filled by a small number of red blood-cells.

Experimentally, upon the brains of rabbits, I have also been able to prove to my fullest satisfaction that comparatively large amounts of liquids may be injected into the brain substance without inducing any gross injury, provided, only, that the injection is carried out with the requisite amount of care. For the purposes of this experiment, I have utilized both living and dead rabbits; as injecting fluid I used in the first experiment normal saline solution; but as this disappeared without discoverable trace, I used in the subsequent experiments normal saline solution slightly tinged with methylene blue.

First Experiment.—Large live rabbit; under ether anæsthesia small opening cut into skull and with fine hypodermic syringe injected one cubic centimetre of salt solution. Duration of actual injection four minutes. Rabbit killed after one hour; examination of the brain showed merely a slight subpial hæmorrhage on the surface of the brain; no visible trace of the injected fluid.

Second Experiment.—Same as first experiment, excepting that I tinged the salt solution slightly with methylene blue. Animal died during the operation; quantity injected twenty minims; duration of injection only a few seconds. Autopsy immediately showed laceration of the brain substance, owing to the rapidity of the injection.

Third Experiment.—Same as second experiment, excepting that the duration of the injection was five minutes. Examination after one hour showed a subdural blood-clot about the size of a ten-cent piece, due to the piercing of a larger meningeal vessel; no laceration of the brain substance.

Fourth Experiment.—Same as third experiment, only that the quantity was increased to two cubic centimetres. Examination showed marked œdema at the seat of injection.

Fifth Experiment.—Brain of dead rabbit; otherwise repetition of second experiment; examination showed laceration of brain substance.

Sixth Experiment.—Brain of dead rabbit; otherwise repetition of third experiment; examination negative.

Seventh Experiment.—Brain of dead rabbit; in other respects repetition of fourth experiment; examination showed some laceration of the brain substance.

Bruno [68] has also found that the injection of one cubic centimetre of normal salt solution after trepanation is not productive of the least harm. Judging from these experiments, I am led to the belief that the living brain can stand without harm the injection of small amounts of fluid; but it must be carried out very slowly, as any undue haste will very probably result in more or less laceration.

Uncalled for injury to the brain may also be caused by an inadvertent movement of the head of the patient during the injection, the needle causing a rent in the brain. To obviate this accident, Rambaud [69] has invented a very ingenious needle, which fits tightly into the trephine opening, and in this manner prevents any independent movement on the part of the needle.

This much has been brought out with definite certainty, that the intracerebral injection is practically devoid of danger, provided it is carried out with the required asepsis, and provided the process of the injection itself is not done with undue haste. Bad results, as sepsis, and laceration of the brain substance, with resulting greater or smaller cavities, are due only to errors or insufficient attention to these details.

Regarding the value of the antitoxin treatment in general, it is well to follow Remesoff and Fedoroff's [70] classification, who divide the cases of tetanus treated with antitoxin into four groups:

(1) Cases in which the symptoms are ameliorated at once after the injection, and then gradually but constantly diminish.

(2) Cases in which there is at first no apparent effect on the symptoms, but improve later on.

(3) Cases in which some of the symptoms become more marked after the injection, but no new groups of muscles become involved.

(4) Cases which continue to grow worse and die in spite of the treatment.

It is recommended and strongly urged that the use of antitoxin be begun as soon as possible after the diagnosis of tetanus has been made in a given case; some observers go even so far as to say that the antitoxin can only do good if used within the first thirty-six hours. I have examined the reported cases, also, with a view to determine this question, and find that, though theoretically it may be, nay is, more proper to begin the use of the antitoxin early, in reality, however, it does not appear to make very much difference, as, contrary to expectations, the cases treated very early in the disease, within the first two days, give a higher mortality than the cases treated later on.

No harm whatsoever, at least none of a permanent nature, has been observed after the use of the antitoxin. Very frequently an urticaria or measle-like eruption has been observed, but it usually disappears within a few days, and does not give rise to any untoward symptoms of consequence.

Before concluding this, one might say the most important chapter relating to the treatment of tetanus, it may be well to call attention to the fact that, even with our best intention, a just estimate of the value of the antitoxin treatment cannot be obtained, and this is caused by the unavoidable circumstance that there exist in the market so many different preparations. I have been able to collect cases treated with the following sources: Tizzoni; Behring; Paris Institute Pasteur; New York Board of Health; Massachusetts Board of Health; Parke, Davis & Co.; British Institute of Preventive Medicine; Gibier; Bujwid; Preisz; Boer, etc. Naturally, when the mode of preparation is considered, it is self-evident that the strength of the various preparations must also differ materially in the amount of antitoxin they contain. Another point which must not be lost sight of is that the dosage, for reasons stated above, varies very much, at least it should do so proportionately to the amount of the tangible antitoxins which are contained in the special serum used. Behring [71] has attempted a measure for

the strength of the antitoxin, but it appears to be doubtful whether all preparations can be brought in under this standard.

It is also remarkable that the cases treated in Italy, by Italian observers, with Tizzoni's antitoxin, are all reported as followed by recovery; it is very difficult to explain this discrepancy with reports from other countries.

No one, perhaps, is better aware than I of the fact that it is both difficult and, for that matter, unjust to draw conclusions from statistics when a point like this is under consideration. But, as a matter of interest merely, I have separated the 338 cases reported according to the make of the antitoxin used, and find the following values:

Of 76 cases treated with Tizzoni's antitoxin, 53 recovered and 23 died; of 61 cases treated with Behring's antitoxin, 35 recovered and 26 died; of 39 cases treated with Institute Pasteur antitoxin, 25 recovered and 14 died; of 28 cases treated with British Institute of Preventive Medicine antitoxin, 16 recovered and 12 died; of 27 cases treated with Roux's antitoxin, 9 recovered and 18 died; of 11 cases treated with Tavel's antitoxin, 8 recovered and 3 died; of 10 cases treated with Parke, Davis and Co.'s antitoxin, 8 recovered and 2 died; of 8 cases treated with New York Board of Health antitoxin, 2 recovered and 6 died; of 4 cases treated with Massachusetts State Board antitoxin, 2 recovered and 2 died; of 3 cases treated with Bernese serum antitetanique, 1 recovered and 2 died; of 2 cases treated with Remesoff and Fedoroff's antitoxin, 1 recovered and 1 died; of 2 cases treated with Gibier's antitoxin, 2 recovered and 0 died; of 2 cases treated with Bujwid's antitoxin, 0 recovered and 2 died; of 1 case treated with Preisz's antitoxin, 1 recovered and 0 died; of 1 case treated with Boer's antitoxin, 0 recovered and 1 died; of 63 cases treated with unknown antitoxin, 32 recovered and 31 died.

4. To immunize the body after infection has taken place. If Buchner's view regarding the action of the tetanus antitoxin is accepted, the entire serum therapy of tetanus is

narrowed down to an immunization of unaffected cell territories. Broadly speaking, however, it involves the injection of antitoxin as a prophylactic measure in all wounds where we have reason to suspect the subsequent possibility of tetanus developing. Unfortunately, but little opportunity is offered in practice to carry this plan out, and to judge of the results. It is now carried out systematically at the Prager Gebähranstalt, reported by Pitha,[72] where, after contending with a somewhat extensive epidemic of puerperal tetanus, it was decided to inject prophylactically all patients on whom operative interference for delivery was indicated, and with this treatment only was the epidemic cut short.

Numerous instances, and with almost uniformly good results, are reported in veterinary practice by Nocard [73] and others.

5. To overcome the symptoms induced by the action of the toxins. As the symptoms point largely to an increased reflex irritability of the higher nerve centres, manifesting themselves in spasms and convulsive movements, our first aim should be to exclude all those factors which tend to provoke spasms; this is best done by isolating the patients and by avoiding all unnecessary jars and noises. An item not to be underrated in the symptomatic treatment is also the administration of such remedies which have a tendency to reduce this reflex irritability. Many remedies have been suggested and lauded as of particular value, but have all been more or less discarded. Among those which have a certain value, I will mention particularly the free use of opium and morphine; chloral administered in maximum doses per os, if it can be so administered, or, if that is impossible, per rectum; the bromides, also, in full doses. Of the other remedies which have been used, I will only mention hyoscyamus, paraldehyde, and physostigma.

As a matter of completeness, it may be well to refer here also to two other methods of treatment:

I. The method suggested by Krokiewitz,[74] which consists of the injection of an emulsion of brain substance. Primarily

this method of treatment is based upon the hypothesis, set up by Goldscheider and Flatau (*loc. cit.*), who, as a result of their research, come to the conclusion that "The morphological changes in the nerve cells are the expression of a chemical process, *i.e.*, of the chemical combination of the toxins with the nerve cells. Every nerve cell possesses atom groups, which have a certain affinity for the atom groups of the tetanus toxins and are able to combine with them." Wassermann and Takaki (*loc. cit*) substantiated this hypothesis experimentally; these observers injected into experimentally tetanized animals an emulsion of spinal cord, obtained from a freshly killed animal, to test, if possible, whether the nerve cells of a dead animal also have this affinity for the tetanus toxins, like the nerve cells of a living animal. By this experiment, they have come to the conclusion that every part of the nervous system, particularly the brain of all examined animals, including man, has a definite and positive tetanus antitoxic power; and that the injection of normal brain substance into experimentally tetanized animals has the power to save life, even several hours after an infection has taken place.

Several cases of recovery have been reported by this method by Krokiewitz,[74] [75] Schramm,[76] Kady,[83] Zupnik,[84] and others.

II. The second method aims at the destruction of the toxins circulating in the system by the repeated injection of large quantities of carbolic acid solutions; and known as Baccelli's method. Many cases of recovery have also been reported by this method, as Ascoli,[77] Natoli,[78] Pieraccini,[79] Ziengo,[80] Metelli,[81] and numerous others.

Résumé.

It is exceedingly difficult to make a brief *résumé* from a paper which treats on so many subjects. In concluding, I would merely suggest the following points:

(1) All forms of tetanus are caused by the bacillus of Nicolaier; hence the diagnosis of rheumatic or idiopathic should have no room in our nosology.

(2) The tetanus toxins appear to have a distinct affinity for the anterior horns of the spinal cord, which may be distinctly recognized by Nissl's method of staining.

(3) The cerebrospinal fluid of tetanus patients is more toxic than the blood.

(4) The antitoxin therapy appears to have a distinct beneficial influence upon the course of tetanus.

(5) With the antitoxin treatment the mortality percentage has been reduced from about 90 per cent. to 40 per cent.

(6) Although the use of the serum is a most important factor in the treatment of tetanus, the other recognized therapeutic measures should not be neglected.

REFERENCES.

[56] Vaillard and Rouget: Annals de l'Inst. Pasteur, p. 385, June, 1892.
[57] Sahli: Mittheilungen aus Kliniken und medicinischen Instituten der Schweitz: Dritte Reihe, Heft 6, 1895.
[58] Blumenthal: Zeitschrift für klinische Medicin, Vol. xxx, 1896.
[59] Bruschettini: Deutsche med. Wochenschrift, No. 16, 1892.
[60] Behring and Kitasato: Deutsche med. Wochenschrift, No. 49, 1890.
[61] Buchner: Münchner med. Wochenschrift, 1893, No. 25.
[62] Buchner: Münchner med. Wochenschrift, No. 38, 1894.
[63] Buchner: Berliner klin. Wochenschrift, 1894, No. 4.
[64] Marchand: Revue méd. de la suisse rom, No. 2, 1899.
[65] Roux and Borrel: Annales de l'Inst. Pasteur, No. 3, 1898.
[66] Blumenthal and Jacob: Berliner klin. Wochenschrift, No. 49, 1898.
[67] Jacob: Berliner klin. Wochenschrift, Nos. 21 and 22, 1898.
[68] Bruno: Deutsche med. Wochenschrift, No. 23, 1899.
[69] Rambaud: New York Medical Journal, December 17, 1898.
[70] Remesoff and Fedoroff: Centralbl. für Bact. und Parasitenkunde, Vol. xv, p. 115.
[71] Behring: Deutsche med. Wochenschrift, No. 2, 1900.
[72] Pitha: Centralblatt f. Gynäkologie, July 22, 1899.
[73] Nocard: Bull. de l'Académie de Médecine, Vol. xxiv, p. 407.
[74] Krokiewitz: Wiener klinische Wochenschrift, No. 34, 1898.
[75] Krokiewitz: Wiener klinische Wochenschrift, No. 28, 1899.
[76] Schramm: Przegad Lekarski, January 21, 1899.
[77] Ascoli: Bulletin della R. acad. méd. di Roma, Fas. iv, viii, 1897, 1898.
[78] Natoli: Gazzetta degli ospedal. e dell clin., No. 43, 1899.
[79] Pieraccini: Policlinico, February, 1899.
[80] Ziengo: Gazzetta degli ospedal. e dell clin., No. 121, 1898.
[81] Metelli: Lancet, November 12, 1898.

[82] Knorr: Fortschritte der Medicin, No. 17, 1897.
[83] Kady: Przgad lekarska, No. 47, 1899.
[84] Zupnik: Prager med. Wochenschrift, Nos. 24 and 25, 1899.
[297] Chaufard and Quenu: Presse Médical, No. 51, 1898.
[298] Garnier: Presse Médical, No. 70, 1898.
[299] Robert: Presse Médical, No. 73, 1898.
[300] Ombredanne: Presse Médical, No. 73, 1898.
[301] Heckel et Reynes: Presse Médical, No. 74, 1898.
[302] Delmas: Presse Médical, No. 77, 1898.
[303] Bacaloglu: Gaz. des Hôpitaux, January 21, 1898.
[304] Du Hamel: Méd. Moderne, August 10, 1898.
[305] Hue: Journ. des Practic., November 19, 1898.
[306] Rambaud: New York Medical Journal, December 17, 1898.
[307] Church: New York Medical Journal, December 17, 1898.
[308] Follet: Bull. et Mém. de la Soc. de Chirurg de Paris, T. xxiv, No. 36, 1898.
[309] Routier: Bull. et Mém. de la Soc. de Chirurg. de Paris, T. xxiv, 1898.
[310] Bousquet: Bull. et Mém. de la Soc. de Chirurg. de Paris, Vol. xxiv, 1898.
[311] Beurnier: Semaine Médicale, p. 485, 1898.
[312] Baudomont: Semaine Médicale, p. 485, 1898.
[313] Forgue et Roger: Bull. et Mém. de la Soc. de Chirurg. de Paris, Vol. xxiv, 1898.
[314] Von Leyden: Berlin. klin. Wochenschrift, No. 29, 1899.
[315] Semple: British Medical Journal, January 7, 1899.
[316] Cuthbert: British Medical Journal, November 18, 1899.
[317] Lawrence: British Medical Journal, June 3, 1899.
[318] Gibb: British Medical Journal, April 15, 1899.
[319] Gibb: British Medical Journal, July 21, 1899.
[320] A. Kocher: Centralb. f. Chirurgie, No. 22, 1899.
[321] Leed's General Infirmary: British Medical Journal, April 1, 1899.
[322] Collier: Lancet, May 13, 1899.
[323] Gimlette: Lancet, July 8, 1899.
[324] Schuster: Deutsche med. Wochenschrift, Ver. B., No. 44, 1899.
[325] Marchand: Revue medic. de la suisse rom., No. 2, 1899.
[326] Pitha: Centralb. f. Gynäkologie, July 22, 1899.
[327] Tavel: Korresp. f. schweizer Aerzte, No. 7, 1899.
[328] Julliard: Revue Méd. de la suisse rom., No. 4, 1899.
[329] Johnson: ANNALS OF SURGERY, March, 1900.
[330] Rogers: ANNALS OF SURGERY, March, 1900.
[331] Kocher: Corresp. f. schweizer Aerzte, February 15, 1900.
[332] Laplace: Philadelphia Medical Journal, March 17, 1900.
[333] Abbe: ANNALS OF SURGERY, March, 1900.
[334] Ehrlich: Klinisches Jahrbuch, Band vi, 1897.
[335] Knorr: Fortschritte der Medizin, p. 657, 1897.
[336] Cobbet: Lancet, August 5, 1899.
[337] Tavel: Korrespondenzblatt f. schweitzer Aerzte, No. 7, 1899.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 25, 1900.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

GRITTI'S AMPUTATION.

DR. A. B. JOHNSON presented a man, forty-six years old, who, when he was thirteen years of age, was severely scalded on the lower part of the right leg. This healed in the course of time, but left a large cicatrix. Some ten years ago the cicatricial tissue began to show evidences of disturbed nutrition, and finally ulcerated; the ulceration resisted treatment, and gradually spread until it became very extensive, extending from just above the ankle to above the middle of the leg, and more than half surrounding the limb. About November, 1899, the patient first noticed that the character of the process on the surface of the ulceration had changed, and that, instead of being more or less excavated, it had commenced to grow actively and projected above the surface of the healthy skin. When Dr. Johnson first saw him, early in January, 1900, there was an area, larger than a man's hand, which was covered by indurated tissue, quite firm and hard, bleeding rather readily, and presenting all the characters of an epithelioma. This diagnosis having been confirmed by a pathological examination of a section of the tissue, Dr. Johnson said he decided to amputate the leg at the knee, as there were no enlarged glands in the groin and the tissues of the thigh were apparently not involved. A Gritti amputation was done on January 20, the patella being secured to the lower end of the femur by means of numerous catgut sutures. Thus far, the speaker said, the result of the operation has been entirely satisfactory; the wound healed without any trouble, and the stump is sound and insensitive.

Dr. Johnson said that in doing the Gritti operation he has

sometimes felt in doubt as to whether it would not be wise to employ a more secure method than mere suturing in order to hold the patella in place. In former years he used a nail for this purpose, but, as this sometimes gave rise to trouble, he has more recently relied upon the insertion of an abundance of catgut sutures.

In reply to a question as to what advantages the Gritti operation possessed over other knee-joint amputations, Dr. Johnson replied that one advantage, theoretically, was that it left a stump which was firmly supported by bone and covered by skin which was normal, movable, and tolerably accustomed to pressure. The stump is certainly more resistant to mechanical pressure than the usual cicatricial stump, and gives rise to far less pain and tenderness. In at least two cases which had come under his observation, the patients, after a Gritti amputation, had been able to sustain the weight of the body on the stump without pain.

Dr. Charles N. Dowd spoke of the comparative rarity of epithelioma of the leg. In one such case coming under his observation, amputation was followed by the occurrence of metastases in the spinal cord and death.

Dr. Johnson, in reply to a question, said he had seen five or six cases of epithelioma of the leg following chronic ulceration.

Dr. B. F. Curtis said he had seen several cases of epithelioma following chronic ulceration. He asked Dr. Johnson whether there would be any difficulty in fitting an artificial limb to the stump left after a Gritti amputation. The stump is so long that it might prove difficult to fit an artificial knee-joint to it.

Dr. Johnson said that the patient he had shown was now being fitted with an artificial limb, and he had seen several similar cases where this had been done satisfactorily. The speaker said that perhaps the chief drawback to the Gritti amputation is that firm union may fail to take place between the patella and femur, and in such a case the former is gradually drawn away by the quadriceps extensor.

MASSAGE IN THE TREATMENT OF RECENT PERIARTICULAR FRACTURES.

Dr. George Woolsey read a paper with this title, for which see page 351.

Dr. Theodore Dunham inquired whether Dr. Woolsey

thought it would be advantageous to employ massage after osteotomy on rachitic children; for example, in cases of knock-knee, where bony union is often delayed and feeble. Whether we could hope to get firmer union by massage, and at the same time improve the general condition of the children by getting them on their feet sooner.

DR. CURTIS said it seemed to him that the method of treating fractures which had been described by Dr. Woolsey had recently been gaining ground, and experience was fast accumulating which would enable us to estimate its true value. The speaker said he had seen two cases in which union was apparently delayed on account of what was probably too vigorous massage. One was a case of fracture of the external malleolus; union failed to occur after a month's treatment by massage, and it became necessary to immobilize the joint for three weeks longer.

Dr. Curtis said he believed that any great amount of motion between the fragments tended to delay the healing of a fractured bone. In several cases of fracture which had come under his observation, where the splint support was defective and the limb was not firmly held, allowing free motion between the fragments, non-union resulted. At any rate, no other reason for the non-union could be made out.

DR. WOOLSEY, in closing, said he thought massage could be safely and advantageously applied in the class of cases referred to by Dr. Dunham, after the osteotomy wound had healed. The delay caused by this would not interfere with the success of the treatment.

The speaker said he had recently seen two cases of malleolar fracture which were treated by massage and resulted in non-union. In both instances the fracture was situated low down, and these cases, as a rule, heal slowly, on account of the poor blood supply of the distal fragment. The cause of non-union is almost invariably due to the application of too vigorous massage, or of the passive motion which should always follow massage. The movements transmitted to the fracture should be so slight as to produce no pain; that is a safe rule to go by.

FIBROMA PLUS TUBERCULOSIS OF THE BREAST.

DR. A. B. JOHNSON presented a specimen obtained from a woman, forty-six years old, who came under his observation

two weeks ago. She stated that fifteen years ago, following childbirth, there was a retention of milk or one of the ordinary phenomena of that period, and this was followed by more or less induration of the breast. Two years ago the patient first noticed a lump or tumor in the centre of the breast, which gradually increased in size, especially during the past few months. When Dr. Johnson first saw the tumor it was about six inches in its transverse diameter, and its centre was surmounted by an ulcerating surface, about two inches in diameter, which represented the nipple. The growth was hard and insensitive. It seemed to be quite firmly attached to the skin, and moderately so to the deeper structures of the thorax. The axillary glands were decidedly enlarged. The growth was regarded as a rapidly growing cancer which had been neglected, and two weeks ago it was removed by the most radical operation. Dr. Johnson said that while dissecting out the skin flaps he noticed that there was a peculiar infiltration of the subcutaneous tissue, and on this account he made the flaps as thin as he dared, removing a large section of the skin and thoroughly cleaning out the axilla.

Under the microscope, the tumor proved to be a very rapidly growing intracanalicular fibroma. The nipple was also in the same condition, the fibrous tissue being greatly increased in amount. In addition to the tumor, it was noted also that the mass was studded throughout with miliary tubercles. The axillary lymph-nodes were very distinctly tuberculous and in a condition of caseation. It was assumed that the tuberculous process resulted from a secondary infection, probably through the nipple.

Dr. Johnson said that, in spite of the fact that so much skin was removed, the tuberculous process had again become manifest, the wound already being surrounded by a zone of indurated, inflammatory tissue over two inches wide and rapidly spreading. The patient's general health is very good, but, on account of the active character of the tubercular process, her condition is almost a hopeless one, a further operation being out of the question.

Stated Meeting, May 9, 1900.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

EXCISION OF TESTIS, EPIDIDYMIS, VAS AND SEMINAL VESICLE FOR TUBERCULOSIS.

DR. PERCY R. BOLTON presented again a patient, whom he had shown at a meeting of the Society some months before, after removal of the left kidney for a tuberculous nephritis.

The man, forty years old, was readmitted to Bellevue Hospital on February 10, 1900, suffering from an enlargement of the scrotum. Examination revealed the fact that the left testis was considerably increased in size, and was hard and nodular. The vas and seminal vesicle on the corresponding side were also enlarged.

On March 9, Dr. Bolton operated by the following method: Two incisions were made, one, four inches long, over the left inguinal canal, through which the vas was excised from the cord. The incision was then lengthened and the testis, epididymis, and proximal end of the vas brought into view and removed. The vas was then followed down into the pelvis and cut off as low as possible, both ends being tied before cutting. The opposite epididymis was then pushed through into the scrotal wound and a portion of it excised. The vas on that side looked normal. The wound was closed as after a Bassini operation for inguinal hernia, chromic acid catgut being used for the deeper sutures and black silk for the skin.

A curved perineal incision, with its convexity upward, was then made, the left seminal vesicle found and isolated, and then removed, the ligated end of the vas coming with it.

The patient made an uneventful recovery. A tube was inserted through the perineal wound, and allowed to remain there until March 15. Five days later the patient was passing all his urine by way of the urethra.

The pathologist reported that the testis and epididymis which had been removed contained many areas of cheesy degeneration surrounded by miliary tubercles. The testis was studded with many miliary tubercles.

TUBERCULOSIS OF THE BODY OF THE SIXTH CERVICAL VERTEBRA CURED BY TREPHINING.

DR. OTTO G. T. KILIANI presented a woman, twenty-eight years of age, who was first seen by him early in January of this year in consultation with Dr. Schwyzer. The family history was positive as to tuberculosis. She herself had had a catarrh of the apex of both lungs, which had healed. Since twenty months she had complained of severe pain in the back of the neck, which was increased by pressure on the processus spinosus of the fifth, sixth, and seventh vertebræ. Lately, the pain had also involved the plexus brachialis of the right side. It finally became so severe that she was unable to sleep or do any work. Motion of the neck was never hindered. The diagnosis of tuberculosis of the vertebra was made, and was verified by a Röntgen plate, in which, for anybody accustomed to studying Röntgen plates, it is easy to see an unmistakable bean-shaped shadow over the right side of the body of the sixth vertebra, which the reporter regarded as a tuberculous focus. The operation of trephining the body of the sixth vertebra was proposed and accepted. With Dr. Willy Meyer kindly assisting, on the 9th of February, 1900, at the German Hospital, he made an incision along the lateral edge of the sterno-cleido muscle. It was comparatively easy to work down to the processus transversus, and from there to the body of the vertebræ, avoiding the vessels and nerves. The œsophagus was lifted from the anterior ligament, which was incised and pushed aside. The body of the sixth vertebra proved to be so soft by fatty degeneration, that the trephining was done with the sharp spoon. No pus or granulations were found. The fifth vertebra was also trephined, but there the hand-chisel had to be used with considerable force. Iodoform gauze tampon was drawn out of the lower angle of the wound, the upper part being sewn up. After four days the pain in the vertebræ was considerably less, and that in the arm began to gradually subside. Recovery was uneventful. After six weeks, plaster-of-Paris corset with jury-mast, which was left off ten weeks after operation. The fistula proved to be somewhat persistent, and showed typical tuberculous, spongy granulations of glassy character. Iodoform gelatin bougies proved to be of value, and the fistula is now closing. Tubercle bacilli were never found in the bone removed.

Dr. B. F. Curtis asked if the microscope showed any definite changes to confirm the diagnosis? The sudden relief from pain in the case reported by Dr. Kiliani was rather remarkable, and seemed to show that orthopædists were not on the right track as regards the treatment of these spinal cases, if such immediate results could be obtained by operation when the original focus was so small.

Dr. Kiliani said that tubercle bacilli were not found, but there were giant cells and evidences of fatty degeneration. It was not deemed advisable to scrape off any of the granulations from the inside of the wound. Histologically, the diagnosis was positive.

Dr. Kiliani said he explained the rapid disappearance of the pain on the ground that it was due to the œdematous infiltration. It persisted, however, for some weeks after the operation.

CARCINOMA OF THE INTESTINES AND PERITONEUM.

Dr. John F. Erdmann presented a boy of nineteen, who, about a year ago, began to complain of pain in the abdomen, which was aggravated upon lying down. About three months later he had some bloody stools, and was treated for dysentery for six months. He then entered the Presbyterian Hospital, where he remained for ten days.

When Dr. Erdmann first saw him in March, 1900, there was marked sensitiveness over the hepatic and splenic flexures, and in the region of the cæcum, and abdominal palpation showed a number of small nodules in those localities. A mass was also found in the rectum, about four and one-half inches from the anus. The boy stated that during his illness he had lost about fifteen pounds in weight.

An exploratory incision disclosed a small mass involving the rectum, two involving the omentum, one the cæcum, and several others in the region of the appendix. Several of them involved the peritoneum and fascia. The case was regarded as absolutely inoperable. Three specimens were removed for microscopical examination, two from the omentum and one from the appendix, and the report on all three was that it was true carcinoma.

Dr. Erdmann said that the primary tumor in this case was

probably in the rectum. Since the exploratory operation, the boy has been able to lie down without pain.

DR. L. A. STIMSON said it was rather remarkable to hear of the number of young patients who were affected with carcinoma. A few years ago it was rare to find it in patients under thirty years of age. Last year, Dr. Stimson said, he saw five cases, all under the age of thirty.

DR. ERDMANN said that two years ago he saw a patient twenty years old with carcinoma of the intestines. In that case, the speaker said, he made an artificial anus.

DR. HOWARD LILIENTHAL said that about two years ago he saw a young man about eighteen years old who had a tumor of the rectum which had been pronounced carcinomatous after a microscopical examination, and a surgeon in Chicago had advised amputation of the rectum. The boy came to New York, where Dr. Lilienthal saw him, and, on account of the age of the patient and the peculiar appearance of the tumor, another section of it was removed and submitted to the pathologist at Mt. Sinai Hospital, who reported that he could find no elements of carcinoma. Although there was no specific history, the boy was put upon energetic antisyphilitic treatment, and a perfect cure was the result. The tumor proved to be gummatous in character, and an abscess had formed within it, which had to be incised; no further operation was necessary.

DR. COLEY said that his case of carcinoma of the breast in a man twenty-nine years old, which he presented last fall, had died about two months later. In that instance the disease had developed when the man was twenty-eight years of age.

TUMOR OF THE MEDIAN NERVE.

DR. B. FARQUHAR CURTIS presented a man, twenty-one years old. When he was ten years of age, a tumor was discovered in the arm, which he says was about half the size of a hen's egg. It gradually grew larger, and when Dr. Curtis saw him recently, its size had about doubled. It was freely movable under the skin, and seemed to be attached by a pedicle to the deeper parts of the arm; otherwise, there were no adhesions nor infiltration of the neighboring parts. There was an entire absence of nerve symptoms, excepting a tingling sensation

along the forefinger; but this was only elicited on pressure or when he used the arm vigorously.

On April 27, 1900, Dr. Curtis cut down on the tumor and found that it lay in the centre of the nerve, the fibres of which were expanded over it. Upon incising the capsule, he was able to shell out the tumor from the centre of the nerve with comparative ease. No nerve symptoms developed subsequent to the operation, but the slight tingling which the patient had complained of previously still persisted. The wound healed by first intention.

The case was interesting, Dr. Curtis said, on account of the size of the tumor, developing between the nerve fibres, combined with the absolute absence of nerve symptoms. The pathologist reported that he was unable to be sure of the exact nature of the tumor. He thought it was not a sarcoma, but so rich in cells that it might prove more serious than an ordinary fibroma, and suggested it would be wise to keep the patient under observation for a time, but not to do anything more at present. The speaker said he hoped it would prove to be purely fibrous, as he was obliged to leave behind some particles of the capsule, which he dared not remove for fear of injuring the nerve fibres, and a recurrence would compel the removal of a long piece of the nerve.

NO RECURRENCE OF HERNIA EIGHT YEARS AFTER OPERATION.

Dr. William B. Coley showed a young man upon whom he had operated early in 1892 for the radical cure of an inguinal hernia by the Czerny method. The hernia relapsed within four months. In the same year he again operated, this time by the Bassini method, with tendon sutures, and thus far there has been no recurrence.

TRAUMATIC CUBITUS VARUS.

Dr. Lewis A. Stimson read a paper with the above title, for which see page 301.

Dr. Curtis said that a very common error in the diagnosis of this class of cases is that they are regarded as dislocations. The speaker said that for some years past it has been his custom in these cases to put the limb in a position of extension for the

first week or two; this appears to be absolutely necessary in the majority of cases in order to prevent lateral deformity.

A STUDY OF ONE THOUSAND OPERATIONS FOR INTESTINAL OBSTRUCTION AND GANGRENOUS HERNIA.

DR. CHARLES L. GIBSON read a paper with the above title, for which see page 486.

DR. CURTIS said the tendency nowadays was in favor of the more complete operation as compared with artificial anus in the treatment of these cases of intestinal obstruction and gangrene. The results of an artificial anus have not proved as favorable as one might imagine. In considering the statistics given by Dr. Gibson, however, the fact should be borne in mind that an artificial anus is sometimes made as a last resort in order to give the patient some relief when his condition makes it extremely probable that he will die immediately, and the high rate of mortality may thus be explained.

NON-MALIGNANT ADENOMA OF BOTH OVARIES.

DR. WILLIAM B. COLEY presented ovarian tumors with the following history:

The patient, female, aged seventy years, had been sent to him in May, 1896, for an operation for irreducible inguinal hernia. The hernia had existed for some years, but had been irreducible only a few months. The diagnosis of omental hernia was made, but on opening the sac, instead of omentum there was found a mass of small cysts exactly resembling a bunch of grapes and filled with gelatinous material. This mass was but loosely attached to the hernial sac. The sac was still patent at the neck, although the small lumen prevented a return of the contents to the abdominal cavity. The mass was about the size of a fist. Hydatids were suspected, but a careful microscopic examination proved negative. Physical examination showed a tumor, apparently solid in character and connected with the right ovary, about the size of two fists; it was freely movable. Its duration was uncertain. After leaving the hospital, the tumor in the abdomen grew rapidly until September, when the patient's condition was such that an exploratory laparotomy was done. On opening the abdomen, he found the cavity filled with a large quantity of

loose gelatinate material, very similar to that found in the hernial sac. The right ovary was the seat of a semisolid tumor about the size of a child's head. A similar tumor occupied the left ovary, but was slightly smaller in size. The serous membrane of the uterus was studded with small infiltrations closely resembling those seen in tubercular peritonitis. Much of the remaining parietal and visceral peritoneum was similarly affected. The tumors were both removed, and as much of the free gelatinous material as possible. This material nearly, if not quite, equalled in bulk the tumors of the ovaries. The patient made an uninterrupted recovery.

From the gross appearance, he had little doubt that he had to deal with a colloid carcinoma, but a careful microscopical examination was made by Dr. B. H. Buxton, who reported it to be non-malignant adenoma. He had watched the patient with considerable interest, fearing a return in spite of the pathologist's report. Her condition has remained normal up to the time of the last report, four years since operation.

POPLITEAL ANEURISM; LIGATION OF FEMORAL ARTERY; GANGRENE OF FOOT; AMPUTATION OF LEG; EMPHYSEMATOUS CELLULITIS OF STUMP; AMPUTATION OF THIGH; RECOVERY.

Dr. B. F. Curtis presented a specimen with the following history:

A man, fifty-two years of age, was admitted to St. Luke's Hospital, January 4, 1899. Is moderately alcoholic. Gonorrhœa thirty-five years ago. For four or five weeks has had pain in right popliteal space, so that he could hardly walk, and two weeks before admission he found a swelling there, which has gradually increased from the size of a bean to its present dimensions. He noticed pulsation soon after he discovered the tumor.

Patient is robust, with a florid complexion. A tubercular syphilitic eruption is on the chin. Lungs normal. Heart apex in fourth space inside of the mid-clavicular line, right border three-quarters inches to right of sternum. Sounds diminished in intensity, first sound rough, but no murmurs, no accentuation, and no tracheal tugging. Radial pulse medium size, regular, increased tension, synchronous on the two sides.

Liver normal. Abdomen normal. Posterior chain cervical

glands and right epitrochlear gland enlarged. Slight erythematous patch on left wrist. Scars on both legs, scalloped and pigmented.

Right leg swollen, measuring one and one-half inches more at calf than the left. In right popliteal space is a pulsating tumor size of a goose egg, with marked systolic thrill and bruit. Dorsalis pedis artery can be felt in both feet, but less strong on right side. The aneurism can be emptied by pressure. Urine, specific gravity 1010, acid; no albumen or sugar, or microscopic elements.

Patient was put upon iodide of potash in full doses up to fifty grains t. i. d. The knee was firmly flexed and secured by bandages, in order to prevent growth of the aneurism, codeine being given for the pain. January 24 all medication was stopped. The eruption on the face had disappeared, and the aneurism was less painful, but was still increasing in size. January 26, the right femoral artery was ligated in Hunter's canal by the usual method of tying in two places and dividing the vessel between the ligatures. Ether anæsthesia.

The operation was followed by great pain in the leg, relieved only by full doses of codeine and morphine. In forty-eight hours a few irregular blue patches were seen on the foot with anæsthesia. The temperature began to rise.

January 31, the wound was dressed and found to be healing by first intention. The gangrene extended on the dorsal surface to the ankle and on the plantar to the heel. This advanced upward until it showed the typical boundary for an occluded artery in Hunter's canal. There was no infection. Leucocytosis, 11,800; Temperature normal.

February 11, 1899, amputation of leg in upper one-third, rather close to gangrenous portion. Line of incision appeared healthy. Ether anæsthesia. The pain was relieved. The temperature became normal after a moderate rise (under 101° F.), and apparently the wound was healing well.

February 18, first dressing. There was some swelling and redness about the wound edges. The next day it was redressed, and a considerable amount of foul serum discharged. The flaps were red and œdematous, with a rather sharp limit to the inflammation just below the knee. Gaseous crepitation was felt in the tissues up to this margin. There was no pain. Temperature

from 98° to 99$^{3}/_{5}$° F., as during the entire week previous, and pulse, 84 to 100, of fair quality. Immediate operation was urged. During the five hours which elapsed before the operation could be done, the red margin and crepitation extended two inches farther up, reaching above the patella.

February 19, 1899, ether anæsthesia. Circular amputation of the thigh at its middle. The incision passed between two and three inches above the upper margin of the inflammation. The wound was closed loosely by a few silkworm-gut sutures, and both angles drained. A dressing wet with 1-3000 bichloride of mercury solution was applied. Dressed twenty-four hours later; the wound seemed clean, with very slight serous discharge, no œdema and no crepitation. The temperature had risen to 100$^{2}/_{5}$° F. at 4 P.M., and it was decided to use the antistreptococcus serum.

February 20, 9 P.M., temperature 100° F., pulse 88, ten cubic centimetres injected; February 21, 3 A.M., temperature 100$^{1}/_{5}$°, pulse 100, ten cubic centimetres injected; February 21, noon, temperature 100$^{1}/_{5}$°, pulse 100, ten cubic centimetres injected; February 21, 8.30 P.M., temperature 101°, pulse 104, ten cubic centimetres injected; February 22, 4 A.M., temperature 100$^{2}/_{5}$°, pulse 100, ten cubic centimetres injected; February 22, 11 A.M., temperature 100$^{2}/_{5}$° , pulse 88, ten cubic centimetres injected; February 22, 5 P.M., temperature 100$^{2}/_{5}$°, pulse 100, ten cubic centimetres injected; February 22, 12 P.M., temperature 100$^{3}/_{5}$°, pulse 92, ten cubic centimetres injected; February 23, 8 A.M., temperature 99$^{4}/_{5}$°, pulse 96; February 23, 4 P.M., temperature 99$^{2}/_{5}$°, pulse 90.

The temperature having dropped, no farther injections were made after February 22.

The wound was dressed twice daily; the angles carefully syringed out with peroxide of hydrogen and drained with iodoform gauze; the wet bichloride dressing was continued until February 25, when a dry dressing of sterile gauze was applied. The wound healed promptly by granulation where it was not sutured.

March 24, the patient was discharged.

The specimen shows that the upper ligature was placed about one-eighth inch below the anastomotica magna, and that a clot

formed in the end of the occluded vessel and extended upward so as to block this important branch.

The case is also interesting as it presents a recovery from that very fatal disease, emphysematous cellulitis. The bacillus aërogenes capsulatus was sought for, but not found. Undoubtedly, the infection was caused by the gangrenous tissue. The entire absence of pain and fever in spite of this severe infection is remarkable.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, January 8, 1900.

The President, WILLIAM W. KEEN, M.D., in the Chair.

SARCOMA OF INTESTINE IN CHILDHOOD.

DR. RICHARD H. HARTE submitted the following history:

A male child, aged five years, was admitted to the Episcopal Hospital on October 31, under the care of Dr. Fisher, with whom the reporter saw the child in consultation. The abdomen of the patient was greatly distended, was very tympanitic, and a distinct mass could be felt on the right side, particularly in the right iliac fossa; slight palpation gave a great deal of pain. On deeper palpation the mass could be felt extending from the right iliac fossa over towards the median line and slightly above the bladder. At times, after the bowels were moved, the mass could be distinctly outlined as two nodular masses about the size of two lemons, one in the median line, and one, as before stated, over the right iliac fossa.

The history, as well as could be elicited from the family, was as follows: About four weeks previous the abdomen was noted to be becoming distended; although there can be no doubt but that the trouble existed long before this and was not recognized. There was no jaundice, no flushing of the face; tongue red and moist; the chest signs were negative; heart in its normal position and action regular; abdomen greatly distended and tympanitic. Over the region of the spleen the splenic dulness was slightly enlarged, although it was with difficulty this could be accurately determined. On the right side of the abdomen was a mass which was distinctly tender, the tenderness increasing down in the right iliac fossa and over towards the median line above the bladder. The child lay with the legs flexed, and when the legs

were extended the pain was increased. When the bladder was distended with urine pain was increased, which was relieved on evacuation of the bladder. The urine contained a faint trace of albumen, with no casts.

The blood count made by Dr. Ghriskey showed the following: Leucocytes, 21,300.

A differential count which was made three days later showed: Polymorphous nuclear leucocytes, 66.6 per cent.; small lymph cells, 24 per cent.; large lymph cells, 9.2 per cent.; eosinophiles, 2 per cent.

While under ether and with the abdomen relaxed, the mass was very much more apparent, and could readily be outlined occupying a space towards the right iliac fossa and extending beyond the median line. An incision was made, which was followed by the escape of a large amount of discolored serum. The growth seemed to be rather cystic in character, although with hard and distinct walls. In one spot it was very soft and ruptured on slight pressure, with more escape of bloody serum.

It seemed very apparent that the case was inoperable, and that nothing could be done except obtain a small piece of growth for microscopic purposes, which proved it to be a lymphosarcoma of the small round-celled variety. The wound was closed, a glass drain inserted, and for a time the child's condition seemed considerably improved; but he ultimately died from inanition, apparently due to the growth breaking into the intestine and allowing the escape of its contents. A post-mortem was made, which revealed a large sarcomatous mass occupying a position starting apparently from the mesentery and involving a portion of the small intestine, the two ends of which seemed to enter the mass, allowing the escape of the intestinal contents through the opening externally, which is very apparent in the specimen. The reporter considered this to be one of those cases of so-called intestinal sarcoma beginning probably in the mesentery, although this apparently is a very rare variety, the intestinal form being more common.

Albion (*Des Fibromes Embryonnaires de l'Intestin chez l'Enfant,* Paris, 1898) has collected ten cases of intestinal sarcoma in children, all of which were of the round-celled variety. The disease occurs at all periods of childhood, and may not infrequently be of congenital origin. Its evolution is extraor-

dinarily rapid, terminating fatally within two months after its apparent beginning. Heredity was noted in none of these cases. Direct traumatism was mentioned in two. The instances of metastatic foci in the viscera had been noted in three-fifths of the cases, in the liver and then in the kidney most frequently. The development of glandular metastasis in regions more or less distant from the primary focus had been noticed with equal frequency with the visceral metastasis, but in only one case was there general involvement of the lymphatic glands.

Again, Smoler (*Prag. med. Wochenschr.*, xiv, 1898), in discussing a series of thirteen cases of primary cancer of the intestines, thinks that they are always infiltrating in their character, affecting the entire intestine and increasing its size. They usually take up a considerable portion of the intestine. Histologically, they are sarcomata of mixed cellular type, although occasionally one sees a case that is lymphoid in character. Metastasis is frequent, affecting the lymphatic glands in the mesentery. The part of the intestine attacked was in seven cases the ileum, twice at its lower end and three times at the jejunum and ileum, and twice the cæcum, and in one case there was in addition an adenosarcoma of the pyloric end of the stomach. The majority of these cases were in the fortieth year.

RESECTION OF WRIST-JOINT.

Dr. William J. Taylor read a paper entitled "A Case of Resection of the Wrist-Joint by a Modification of Mynter's Method," for which see page 360. He also presented the patient for examination.

Dr. H. Augustus Wilson remarked that the hand was still bandaged, and that immobilization was still maintained. He suggested that increased freedom of movement might increase the flexibility of the fingers and develop the muscles, thereby gaining usefulness of the hand. He said that this case had recalled to his mind a case of an elbow-joint, that was the most flail-like joint that he had ever seen, in which the muscles were educated to such coördination as to bring the arm into almost perfect use. This case of Dr. Taylor's is the most perfect excision of the wrist that he had ever seen; but there is a flail-like disability which might be overcome in the same way that the usefulness of the elbow referred to was re-established; although there

are many obstacles in this case, for, besides the loss of function of the wrist, there is an absence of animus, so essential to the successful accomplishment of the desired end.

Dr. Richard H. Harte said that the wrist is the most unsatisfactory joint in the body to excise. In the first place, the old methods of attacking the joint were always unsatisfactory, owing to the impossibility of getting at the joint without sacrificing the tendons of the muscles. The method practised by Dr. Taylor allows one to attack the joint by simply throwing the tendons to one side, so that one can practically then remove all the bones with the scalpel, forceps, or scissors. By the old method everything had to be removed piecemeal with forceps. The results in these cases, to his mind, were always very unsatisfactory. The cases, after they had had bones removed, dragged along for a long time, and it was a question if it was not always better to amputate the hand in the beginning rather than waste the time dragging along with the hopes of getting some results from a resection. One reason, he thought, why there is still so much impairment of function in this particular case is, that, having removed both rows of the carpus, the amount of fibrous tissue intervening between the bones of the forearm and the metacarpus is so great that it contracts very slowly. It is not like the removing of the same amount of bone in the forearm. There the contraction is very rapid, and the two ends of the bone are brought into relation at once, and there is practically no impairment of function of the muscle. But in this wrist there is nothing but tendinous tissue, and contraction is very slow. It is a flail-joint, and it will be some time before the patient will have the use of his hands as he had them before. Advantage might follow the use of some mechanical appliance which will act as a support between the lower end of the radius and the end of the metacarpal bone, and will increase the functions of the fingers very materially.

Dr. W. J. Taylor replied that repeated efforts had been made to do without some form of support. The man has also a perfectly ankylosed shoulder-joint on the left side; therefore, he is very much more helpless than a man would be who is able to use that arm. He is very much handicapped, inasmuch as he cannot get his right hand over to his left, and he begins by taking his right over to his left to enable him to do anything. Whenever all forms of support are removed, he is quite helpless with

the two disabled limbs. He is able to get better motion in the fingers if there is some form of support. He is getting daily massage at the Orthopædic Hospital; and he is therefore getting a great deal of exercise to the arm, wrist, and fingers. The amount of stiffness in the hand is much less to-day than it was before any operation was done. No very forcible methods to overcoming this stiffness were made at the time of operation. The second time he was etherized the hand was limbered up fairly well; but he is a man who does not bear pain very well; and he has so much the matter with him in addition,—a large abscess in his chest and tuberculosis of the lung, with almost constant pain and cough,—it has been impracticable to do more.

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PLATE XIII.

A SKIAGRAPHIC STUDY OF THE NORMAL MEMBRAL EPIPHYSES AT THE THIRTEENTH YEAR.

By EUGENE R. CORSON, M.D.,

OF SAVANNAH, GA.

Foreword.

My object in making these skiagraphic studies of the normal membral epiphyses is to show what the X-ray can do for us in the investigation of the development and growth of the bones, and to furnish an aid in the interpretation of the

PLATE XIII.

A skiagraph of the carpus and the lower epiphyses of the ulna and radius from the palmar surface, somewhat magnified, to show what can be done in producing enlarged figures for anatomical study. While, of course, the outlines are not so sharp, the detail of the spongy tissue of the bones is more evident than in the skiagraph of normal size. This method seems to me worthy of further trial in the preparation of anatomical charts for the lecture-room and the laboratory. Only by frozen section can be obtained the absolutely normal relations of the bones as here depicted; no drawings from dried or wet specimens could so accurately outline for us the epiphysis, shaft, and intervening cartilage. In the radius at this age we can see the beginning bony spiculæ bridging the cartilaginous interval, though some time must yet elapse before firm bony union is accomplished.

The relation of trapezium and trapezoid to the metacarpal of the thumb is well brought out.

Compare this figure with the ones given in Gray of the carpal bones, and its superiority becomes at once evident. In the former the bones are spaced as they really are, in the latter they are united as in the prepared skeleton.

X-ray findings when these parts and their relationships are altered by disease or trauma. Before we can interpret correctly the fluoroscopic image or the skiagraph of the fractured bone or separated epiphysis, we should have before us a skia-

graphic picture of the normal parts and in their normal relations. We cannot then go astray, and, moreover, the eye will be prepared to take in much which it would otherwise fail to see.

I trust, too, that these plates will prove useful in conjunction with the work of Mr. John Poland, F.R.C.S., on "Traumatic Separation of the Epiphyses," a work of great research and great learning, and from which I have drawn largely in my brief descriptions of the development of the epiphyses.

The skiagraphs are all from one subject, a mulatto boy of thirteen years; they are practically untouched, and represent simply the prints on "velox" paper of carefully made negatives.

The X-ray will prove to be a valuable aid in the study of

PLATE I.

Skiagraph of right shoulder from behind, showing body and spine of scapula, coracoid process, and glenoid cavity, and the entire epiphysis of the humerus, comprising the head and the greater and lesser tuberosities. The bicipital groove can be made out. Faint evidence of beginning ossification in proximal centre of acromion, the rest of this process cartilaginous; distal end of clavicle still partly cartilaginous; distal end of coracoid cartilaginous.

Exposure, four minutes.

many points in normal anatomy. The bone relationships in joints, the various joint movements, and the different steps in bone development can all be studied in a striking way by the X-ray. I have already attempted to show the normal movements of the carpal bones and wrist by this new method,[1] and I shall now attempt to show what can be done in a study of the normal membral epiphyses at an age nearly midway between birth and perfected adult growth.

I have been prompted to do this work from the great impetus given to the study of fractures and traumatic separations of the epiphyses by the discovery of Röntgen, a discovery which makes possible and easy an absolutely correct diagnosis where previously uncertainty and error outweighed definite knowledge. To intelligently interpret the X-ray find-



PLATE I.

ings in traumatic separations of the epiphyses, we should have before us good skiagraphs of the normal joints during the formative period. With these as a basis for comparison, it will be easy to recognize any deviation from the normal, be it from trauma or from disease.

Germany, which still leads in all that pertains to the X-ray, has already begun an "Atlas der Normalen und Pathologischen Anatomie in Typischen Röntgenbilder," of which two parts have already appeared, one dealing with the process of ossification and the development of the fœtal skeleton, and one with the congenital malformations of the upper extremity.

Mr. John Poland, F.R.C.S., has published a "Skiagraphic Atlas showing the Development of the Bones of the Wrist and Hand" (London, Smith, Elder & Co., 1898), which shows how instructive this comparative X-ray study is. Even in the two years which have gone by since the publication of that work great progress has been made in X-ray technique, so that we can now get skiagraphs which bring out most beautifully the internal structure of the bones and make even plainer the smaller centres of ossification. This will be shown in the skiagraphs illustrating this work.

Mr. Poland has put the profession in much greater debt to him by the publication of his great work on the traumatic separation of the epiphyses;[2] an encyclopædic work, the result of many years of rich experience and careful study. The many references to the complete literature of the subject bear witness to great labor and judgment, and the many illustrations and skiagraphs bring the book well up to date. A skiagraphic atlas of the normal epiphyses will add, I trust, to the value of this work, and I have undertaken it with this object in view. In my short descriptions of the development of the different epiphyses, I have drawn largely from Mr. Poland's work, being well assured of its accuracy. The most casual survey of medical periodical literature shows how many are working in this new and fascinating field, and the secret of it all is the satisfaction and the fascination of making absolutely

correct diagnoses in cases which heretofore left much in doubt if not in total obscurity.[3]

The X-ray is most wonderfully adapted to this work, cartilage being practically transparent to the ray, the division line between epiphysis and shaft is clearly brought out, and the sensitiveness of the ray to the presence of any earthy salts in the cartilage enables us to show the very earliest beginnings of ossification. By this method, then, we can go over again the entire field of bone development, and it will undoubtedly definitely settle some mooted points and change some of our data as put down in the standard text-books. Further investigation by this method will show, I believe, that ossification in the various bones is usually somewhat earlier

PLATE II.

Left elbow from behind, coronal view, showing all the epiphyses at the joint. Wedge-shaped lower epiphysis of the humerus comprising the capitellum and trochlea; very faint indication of beginning ossification of external epicondyle.

Epiphysis of internal epicondyle well developed; olecranon fossa very distinct.

Epiphysial head of radius.

Epiphysis of olecranon; the main body of the olecranon with the outlines of the greater and lesser sigmoid cavities all very distinct.

The spongy texture of the bone well brought out.

Exposure, three minutes.

than previous research has determined, for the X-ray will show the shadow of the earthy salts before the knife and the naked eye can detect them. In the subject of my experiments I have found almost all the epiphyses further developed than the text-books would indicate, and certain others started which, according to the authorities, had no right of existence. The skiagraphs are all from the one subject, a light mulatto boy, born on August 29, 1887, so that he will not be thirteen years old till this coming August, 1900. Thus the skiagraphs were taken in the last three months completing his thirteen years. His height in his stockings is four feet six inches, and his weight is seventy-five pounds. He is a healthy, muscular boy,



PLATE II.

and the skiagraphs will show good bony development for his age.

In my earlier X-ray work I intrusted the developing and printing of the plates to a professional photographer; but I soon found that, unless I had him entirely at my beck and call, it was impossible to do any systematic work. There were certain differences in photographic technique to produce prints from the negatives, such, at any rate, as I conceived they should be, that he had much to learn, just as I had to learn the entire process, having had no previous knowledge or experience in photographic work. I found that what the professional would regard as a fine negative did not always give a satisfactory print, one that gave the deep and essential details without the superficial ones and the flesh. Thus I found that every negative had to be intensified just as regularly as the plate was developed and fixed. There were further difficulties to be overcome in printing which did not exist in ordinary photographic work. This is not the place to give the details of this work, and I shall describe them in a separate paper. I shall simply state that my X-ray outfit is composed of a Willyoung fifteen-inch spark coil energized by thirteen storage cells of chloride accumulator type D. 5, with a Queen independent vibrator. I have used entirely the Queen self-regulating X-ray tube, a marvel of ingenuity and efficiency. I have used the Carbutt X-ray plates as well as the Seed's extra-rapid plate, No. 27. This latter plate is cheaper and just as good as the Carbutt, and I use it now entirely. I have found that the Eastman hydrochinon developing powders are as good as, perhaps better than, any other developer, and very handy. I use a chrome-alum fixing bath as given by Carbutt and Carbutt's formula for the intensifier. For a printing paper I use solely the "carbon matt velox," which has many advantages over all other printing papers, at least to produce prints as I conceive they should be.

These skiagraphs are very different from any I have seen. I have attempted to bring out the bones on a perfectly white background and with all the detail possible. They show the

normal joints and epiphyses at a stage of development sufficiently advanced to bring out all the epiphyses and the bony structure of the joints. I hope to demonstrate how clearly the X-ray can show us these parts and with the very texture of the bone in many cases. If the print could be made to equal the negative in the minuter details the skiagraph would be better than the photograph of the bone itself, for the negative gives us the internal structure, and you get, moreover, a depth and a perspective to your picture. One can but marvel at these shadows, for they are both shadow and substance.

With these normal skiagraphic pictures before us, it will be easy to compare the abnormal views we get when disease or trauma alters the parts and their relations. To interpret

PLATE III.

Skiagraph of elbow from inner side, sagittal view, showing all the epiphyses of the joint. Capitellum and trochlea of the humeral epiphysis very prominent, especially the former. The compact bone of the shaft meeting at the thin partition which separates the olecranon fossa from the anterior surface, and expanding into the circular ridge of the trochlea, so characteristic of sagittal sections of the humerus, well shown. Osseous granules at the inner and small end of the epiphysial wedge. Epiphysis of internal epicondyle.

Epiphysial head of radius.

Epiphysis of olecranon.

Greater and lesser sigmoid cavities and coronoid process.

Exposure, three minutes.

properly the skiagraph of a fracture or a dislocation, it is necessary that we have a picture before us of the normal parts *and in their relations as the X-ray shadows show them.* There has been much written about the deceptions of the X-ray tending to depreciate the value of this method. In the same spirit the revelations of the microscope or any other delicate instrument could be depreciated. In fact, to the unpractised eye the microscope is much more liable to lead one astray, for the proper conditions are more difficult to learn, and a much longer practice is necessary to enable one to interpret correctly the findings. The case with the X-ray is simpler, and with a proper understanding of the nature of these shadows cast upon the



PLATE III.

fluoroscopic screen or the photographic plate, it soon becomes easy to take in the pictures at a glance. The very fact that we are dealing with shadows should show us that more than one point of view is necessary to judge correctly. A shadow has but two dimensions, and a second shadow at right angles to the first becomes necessary to give us the three dimensions. This is strikingly shown in certain cases of fracture where from one point of view the apposition of the broken bones seems perfect, while from a view at right angles to the first the displacement of the broken ends becomes evident. In a fine negative, as I have said, we get more than the mere two dimensional shadow; being a translucent shadow, we really get depth and perspective to our picture, and in some cases this is most beautifully shown.

When the proper conditions are known, the X-ray cannot deceive; its revelations are infallible. Before the pathologist can interpret his microscopic findings, he must know his normal histology. So with the skiagrapher, he must know and have before him the normal skiagraph before he can interpret properly the abnormal.

Shoulder.

Plate I shows the right shoulder from behind, the scapula resting on the plate. We have here three bones to consider. The clavicle develops from two centres, one for the shaft and one for the sternal end, having, therefore, but one epiphysis. The centre for the shaft appears very early, earlier than any other bone, according to Béclard, as early as the thirtieth day. Strange to say, the centre for the epiphysis does not appear before the eighteenth or twentieth year and unites with the shaft at the twenty-fifth year. This epiphysis does not concern us here.

In our subject, the acromial end of the bone is still partly cartilaginous. The entire bone being small and some distance from the plate gives but a faint shadow. In the adult with the bone fully ossified it is better shown. In the negative it is much better defined. To have brought it out more distinctly

in the print, the other bones of the shoulder would have been too dark for any details. The scapula develops from seven centres, one for the body appearing about the eighth week, two for the coracoid process, two for the acromion, one for the vertebral border, and one for the inferior angle. The last two do not concern us here. The centre for the coracoid proper appears early, about the first year; while the centre for the subcoracoid bone does not appear till about the seventeenth year. Of the two centres of the acromion, the one at the base appears about the fifteenth year and the distal one a year later. According to Poland, the glenoid cavity consists of four parts, that of the body of the scapula, the internal portion of the coracoid, the subcoracoid bone, and a thin epiphysial plate at the margin of the glenoid, thicker at the edge and thin towards the centre. These all joining and forming the glenoid cavity proper from the twentieth to the twenty-fifth year.[4]

PLATE IV.

Skiagraph of the lower epiphyses of radius and ulna with carpus, from the dorsal surface. Somewhat enlarged.

Epiphysis of ulna with rudimentary styloid process.

Epiphysis of radius.

Proximal epiphysis of metacarpal of thumb and epiphysis of its first phalangeal bone.

Exposure, one minute.

Examining the skiagraph, we find a well-developed body and spine and an evident beginning ossification in the proximal end of the acromion, though Gray puts this two years later, and Poland one year later, or at the fourteenth year. The spine comes out very sharp with radiations at the base out into the body of the scapula. The short stubby coracoid is well in evidence; it is evidently already joined to the body of the bone; the apex is still cartilaginous. The acromion proper is still largely cartilaginous, though we have faint indications of beginning ossification in the proximal end, more plainly shown in the negative. The glenoid cavity appears still immature. At the outer edge we begin to see evidence of the formation of a rim. Altogether, at this age, the scapula is fairly well developed.



PLATE IV.

According to Poland, osseous granules appear in the upper epiphysis of the humerus about the middle of the first year. "About the end of the first year these granules begin to group themselves into three centres, that for the head appearing first at the beginning of the second year, and that for the greater tuberosity during the third. The centre for the lesser tuberosity is not well marked until the end of the fourth year, at times as late as the end of the fifth. At this period these three centres are pretty accurately divided from each other by the anatomical neck and the bicipital groove; they begin to blend with each other about the sixth year (some anatomists state from the third to the fifth year), the lesser tuberosity joining first by its upper part with the head and greater tuberosity, and the latter being still separated from the head by a layer of cartilage. It is therefore possible to have a separation of the epiphysis of the head alone.

"Somewhat later the greater tuberosity blends with the upper part of head, and the large upper epiphysis is fully formed.[5]

"The cuplike epiphysis rests with its concavity upon the pointed concave end of the diaphysis. The cone-shaped end of the diaphysis only develops as age increases; in infancy it is almost flat, and afterwards becomes slightly convex."[6]

In the skiagraph the completed epiphysis comes out clearly separated from the shaft. The centre of the greater tuberosity appears faint from being viewed free from the shaft, and ossification not being complete. The cone-shaped end of the diaphysis is beautifully shown. The heavy shadow below the line of demarcation shows us the centre of the lesser tuberosity viewed through the cone-shaped portion of the shaft. We can see here how the epiphysis overlaps the shaft like a cup. Below this again we see the fainter line of demarcation of that portion of the bone away from the plate. Thus the three divisions of the epiphysis are brought out, the two lines marking out for us the anatomical and surgical necks. The skiagraph compares very favorably with the drawings of the parts themselves.

Elbow.

The epiphysis of the lower end of the humerus is the most difficult to understand in its development, and about which there is still some discrepancy existing among authorities. The elbow-joint, moreover, is perhaps the most important one surgically, especially in the traumatic separation of its epiphyses, and from fractures extending into the joint. Nowhere can I find a more exhaustive study of this joint than in the work of Mr. Poland, and I shall make use largely of his descriptions.

Up to the third year this epiphysis is almost entirely cartilaginous, barring a few osseous granules in the capitellum. It is at the end of the third year only that the nucleus of this portion is well advanced. By the end of the sixth year ossification is well advanced, extending inward, and forming the outer half of the trochlear surface, but it remains till the fifteenth or sixteenth year free from the shaft.

PLATE V.

Skiagraph of the lower epiphyses of radius and ulna with carpus, from the palmar surface.

Exposure, one minute. Somewhat enlarged.

" By the sixteenth year the whole of this portion of the articular surface is entirely osseous, and forms a hemispherical mass, with its convex surface below and in front towards the cup of the radius, whilst its upper slightly excavated surface is presented towards the end of the diaphysis." [7]

" In the cartilage of the *trochlea* an osseous centre next becomes visible towards the projecting part or inner lip of this surface. Sometimes there are two, the second smaller one being more external and soon blending with the larger. This appears between the eleventh and twelfth years, at times a little later." [8]

The last to appear at the thirteenth or fourteenth year is the nucleus for the outer epicondyle, uniting finally about the sixteenth year with the epiphysis proper.

" About the fifteenth or sixteenth year the two portions



PLATE V.

of the articular surface formed by the capitellum and trochlea blend together (commencing at the groove of the trochlear surface) and produce one articular surface; the external epicondyle is then joined on. These three portions form by their junction the lower epiphysis of the humerus, which does not include the internal epicondyle. This is relatively to the developing shaft much thinner than the cartilaginous lower end of the humerus of infancy, consequently the epiphysial line of junction is much nearer to the articular cavity than in the earlier period of life.

"The internal epicondyle forms a distinct epiphysis by the downward growth of the diaphysis separating it from the rest of the end of the bone, which usually unites with the diaphysis without blending with the trochlea. This junction is effected from the eighteenth to the twentieth year, but as late as the twenty-fifth year traces of the line of junction may still be seen.

"The lower end of the bone decreases relatively in size as childhood advances." [9]

At the twelfth year the olecranon and coronoid fossæ are formed almost entirely in the shaft, while in infancy the epiphysis completes the lower part of the olecranon fossa. At birth the epiphysial line is almost transverse, and remains for some time completely above the epicondyles. The diaphysis thickens at each side to form the lateral projections, and growing downward forms the whole of the olecranon fossa, but especially at the inner side towards the internal epicondyle, apparently at the expense of the epiphysis. The shaft penetrates, as it were, the trochlea, thus supporting and strengthening the epiphysis. However, on the outer side, the epiphysis remains much thicker,—nearly double the size of the trochlea, and is not invaded by the diaphysis.

At thirteen years the epiphysial line runs obliquely downward and inward, the epiphysis on the inner side being thin, and limited precisely by the cartilage-clad area in front and behind. On the inner side it rises slightly towards the internal epicondyle, still almost separated from the growing diaphysis.

The external epicondyle is rarely isolated in the same manner from the epiphysis.

"The epiphysial line of the epiphysis proper, comprising the external epicondyle, the capitellum, and the trochlea, is therefore very obliquely placed if we draw a transverse line uniting the apices of the two epicondyles. The plane of the articular surface likewise makes an acute angle inward with the same transverse line. On the outer side the epiphysial line terminates above the external epicondyle, on the inner side below the internal epicondyle." [10]

The epiphysis of the internal epicondyle is firmly united to the shaft by the seventeenth year. After this the growth in length of the humerus is arrested so far as the lower extremity is concerned, but is carried on by the epiphysis of the upper extremity till fully formed.

Mr. Poland has most minutely described the entire pro-

PLATE VI.

Skiagraph of hand from the dorsal surface, showing the epiphyses of all the bones of the fingers, with the internal structure of the bone.

Exposure, one minute.

cess, and no book to my knowledge gives one such a clear idea of the anatomy of this important joint and the different steps in its development. I am indebted to him for all the facts in the case. And where I have not used quotation marks, I have only slightly changed his wording and sequence in order to condense somewhat his minute description. This will help us to understand the skiagraphs, and it will be seen how beautifully the X-ray findings bear him out, and were we to skiagraph the elbow for each year of its development, the whole developmental process would be studied about as well as on the cadaver.

Plate II gives an antero-posterior or coronal view of the elbow, and brings out clearly the epiphysial development of the joint at this age. The internal epicondyle is well developed and entirely independent of the humeral epiphysis proper. It has become an apophysis of the humerus, and we can readily



PLATE VI.

see how the shaft has grown down towards the joint on the inner side, so well described for us by Mr. Poland, changing the original transverse epiphysial line to an oblique one, inward and downward. At first glance the epiphysis seems reduced to a narrow wedge, but a closer inspection will show a second fainter epiphysial line seven millimetres above the first, showing us the oblique epiphysial surface overlapping the shaft anteriorly and seen through its thin lower end. We thus get an absolutely correct shadow of this epiphysis which we can measure accurately, the bone coming so close to the photographic plate that there is practically no enlargement. As the skiagraph was taken with the posterior surface on the plate, the lower and more distinct epiphysial line is posterior and the upper is anterior, the entire epiphysis still preserving its characteristic wedge-shape. The capitellum is well shown and its relation to the head of the radius. We have a faint trace of the nucleus for the external epicondyle. The trochlea is not evident in this view. We can see beautifully outlined the olecranon fossa, and that it has become quite entirely a part of the diaphysis, a feature already mentioned. The internal end of the epiphysial wedge terminates in almost a sharp point, showing how ossification has well advanced to the inner trochlear border.

Plate III gives a side or sagittal view of the joint, bringing out the other features of the epiphysis to complete the picture. This view is taken with the inner side of the joint on the plate, but is, however, not accurately transverse, but somewhat obliquely placed, the obliquity being inward and backward. The prominent capitellum is well shown still separate from the shaft, and somewhat enlarged by being some distance from the plate. It should ever be borne in mind that the further the object is from the plate the larger the shadow as well as fainter. It is only when the object is directly on the plate that the shadow and the object correspond. The trochlea is represented by the two curved lines and the small shadow lying apparently in the joint, the external border or lip being represented by the smaller and darker curve, almost a complete

circle, and so characteristic in sagittal sections of the lower end of the humerus. The internal border or lip is represented by the larger and fainter curve, the smaller shadow below being the most internal point of the epiphysial wedge ultimately helping to form the prominent internal border of the trochlea, and corresponding to the point of bone just within the internal border of the olecranon shown in the coronal view in Plate II.

The internal epicondyle is well differentiated, though not so strikingly shown as in the other view.

A study of these two views gives us a very complete picture of this intricate epiphysis. An even more complete

PLATE VII.

Skiagraph of the hip from behind with the foot everted, the thigh abducted, and the greater trochanter as close to the plate as possible, showing the epiphyses of the greater and lesser trochanters and the epiphysial line of the head of the femur.

Epiphysial junction of ilium and pubic bones with the acetabulum all very distinct.

Exposure eight minutes. By using a fluorescent screen, the exposure is one and one-quarter minutes.

study of this joint could be made by taking one or more skiagraphs at somewhat different angles. By the X-ray we should be able to diagnose easily a traumatic separation complete or partial of this lower epiphysis of the humerus, provided, of course, the skiagraph is a good one. I have seen some poor ones published where it was very difficult or quite impossible to diagnose exactly the injury sustained.

The ulna develops by three centres, one for the shaft appearing about the fifth week, one for the lower extremity, appearing about the fourth year, and one for the end of the olecranon, appearing about the tenth year.

The upper end of the ulna cartilaginous for the first few years includes the upper half of the olecranon, its anterior joint surface, and the coronoid process. As the shaft ossifies and grows upward, this cartilaginous portion is gradually reduced, until by the eighth year the epiphysis of the olecranon



PLATE VII.

alone remains. The olecranon, therefore, is almost entirely a part of the shaft. As late as the tenth year, or later, the tip of the coronoid process may still be found cartilaginous. It disappears during the growth and development of the coronoid without undergoing any separate ossification.[11]

An ossific centre appears at the end of the cartilaginous olecranon about the tenth year, joining the shaft and forming a completely ossified olecranon at the fifteenth or sixteenth year.

Mr. Poland describes a second nucleus, often seen as early as the fifth year, forming "the outer side of the upper part of the sigmoid cavity and the tip or beak of the olecranon and a small portion of the inner side of the sigmoid cavity."[12]

In Plate III, the sagittal view of the joint, the skiagraph brings out very clearly the epiphysis of the olecranon. It shows, also, how well advanced is the ossification of the sigmoid cavity; and in the lighter shading one can see clearly the outlines of the lesser sigmoid cavity with the play of the head of the radius in it. The smoothly rounded coronoid process shows that complete ossification here is still lacking, for in the adult coronoid process there is quite a sharp point beautifully brought out by the X-ray. The epiphysis of the olecranon can also be seen in Plate II, the coronal section, though not so clearly. Both plates show us plainly how well advanced ossification is in the olecranon, and how largely it is but a part of the shaft of the bone, formed by the upward growth of the diaphysis.

The development of the radius follows the same general schema, one centre for the shaft, appearing about the fifth week; the centre for the lower extremity about the second year and joining the shaft about the twentieth; and the centre for the head about the fifth year and joining the shaft at puberty.

According to Poland, the centre of the head appears about the sixth year, is completely ossified at the sixteenth year, and joins the shaft early in the seventeenth year, at times a little later.[13]

"Rambaud and Renault describe a number of accessory osseous nuclei which are placed in a remarkable manner around the principal central plate, and when joined together and to the central portion form the characteristic concavity of the epiphysis." [14]

The epiphysial head of the bone is beautifully shown in the two skiagraphic views, still ununited to the shaft. That ossification is still incomplete is evident from the fact that there is no apparent neck to the bone, and that the head barely projects beyond the shaft, so different from the adult bone, when there is a clearly defined neck and where the head projects from two to four millimetres beyond this neck all around.

It will be noticed that there is practically no bicipital

PLATE VIII.

Skiagraph of knee from behind, coronal view, showing lower epiphysis of the femur and the upper epiphyses of the tibia and fibula.

The sinuous line of the femoral epiphysis with the two condyles and the intercondyloid notch very distinct.

Faint shadow of the patella.

The upper epiphysis of tibia with its superior articular surface, its spine and the tubercle on each side.

The upper epiphyses of fibula.

Exposure, four minutes.

tuberosity at this age. Mr. Poland describes a small epiphysial plate developed about the sixteenth year to form the bicipital tuberosity and which rapidly joins the shaft. This bicipital tuberosity is of course distinctly shown by the X-ray in the adult radius.

Wrist.

The two epiphyses of the wrist are easily seen and studied by the X-ray, for the joint lends itself most favorably to fluoroscopic examination, as I have attempted to show in my paper on the normal movements of the carpal bones and wrist.

According to Gray the centre for the lower epiphysis of the radius appears about the second year, the centre for the ulnar epiphysis about the fourth year; they join their respective shafts about the twentieth year. Mr. Poland, in his

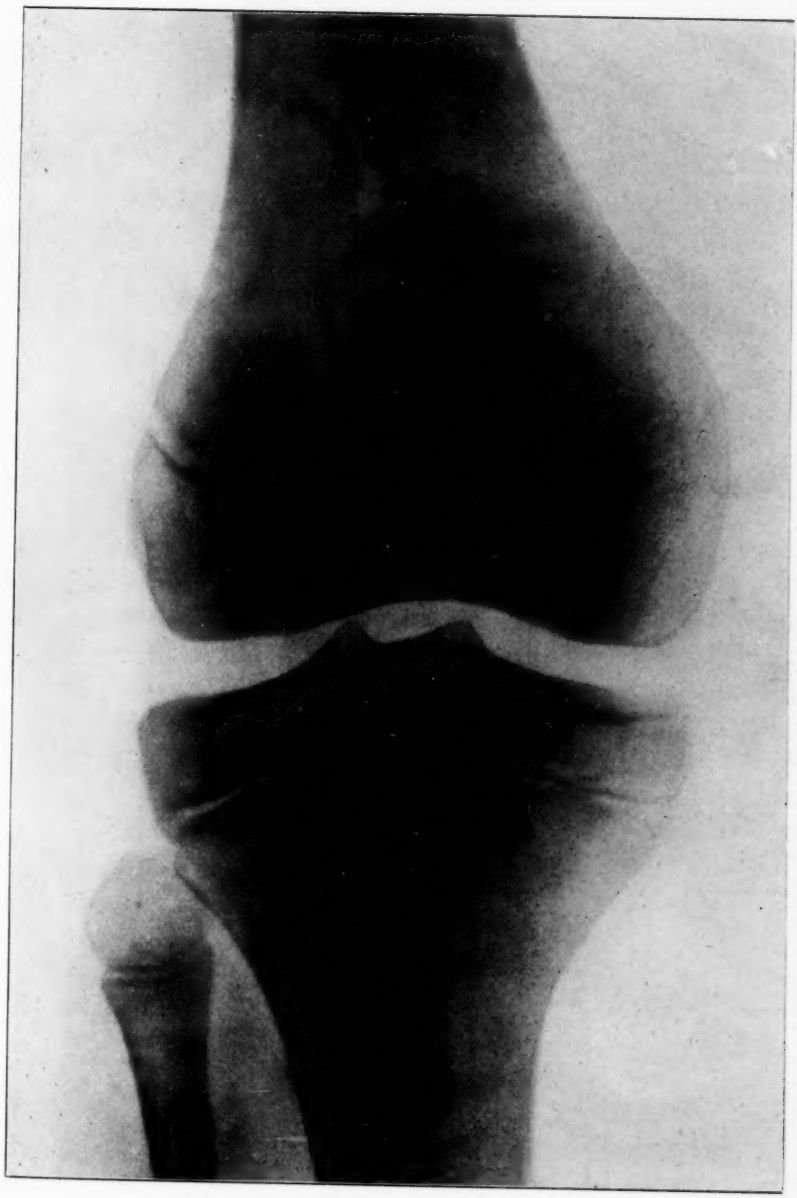


PLATE VIII.

"Skiagraphic Atlas showing the Development of the Bones of the Wrist and Hand," shows us well the skiagraphic findings of these two epiphyses from the first year up to the seventeenth year. He shows us the hand of an infant just one year old where ossification in the radial epiphysis is already well started, while in his skiagraph for the sixth year the osseous nucleus for the ulnar epiphysis has but just appeared. That the radial epiphysis should appear first is what we should have expected, remembering that the radius is the most important and largest bone at the wrist, being directly concerned in the joint, while the ulna is only indirectly so. These two bones reverse their relative importance at elbow and wrist; at the elbow the ulna is the important bone and the radius but the hanger-on, while at the wrist the ulna has become the hanger-on.

In his larger work, Mr. Poland writes, "About the fourth, fifth, or sixth year, the chief nuclei of the carpal extremity appear towards the centre of the head and base of the styloid process. These lie close together, and soon blend, forming an osseous plate which extends downward on the inner side into the styloid process. This process is formed principally from this centre, but an additional centre is sometimes seen at the summit, appearing about the twelfth year, and joining the rest of the osseous epiphysis three or four years later." [15]

Of the radial epiphysis, he writes, "Towards the end of the second year the osseous nucleus of the lower epiphysis of the radius appears above the scaphoid facet." [16]

He alludes to this discrepancy in his description of the first skiagraph in his "Atlas." Certain it is that the X-ray will modify many statements that appear in our standard anatomical works relative to the centres of ossification.

In our own skiagraphs of the wrist and hand the epiphyses are well brought out, showing, however, certain differences, whether taken from the dorsal or palmar aspects.

In Plate V the skiagraph is taken from the dorsal side, and in Plate IV from the palmar. We get a narrower shadow of both ulnar shaft and epiphysis from the dorsal surface,

and you get, besides, an evident beginning styloid process which you do not get from the palmar surface, the rudimentary styloid process being nearer the plate in this case. You can make out an osseous ring at the base of the styloid, the double shadow of its base and epiphysis proper.

Slight differences can be made out in the carpal bones depending upon the surface exposed to the plate, too slight to be of any practical importance. The differences in the radial epiphysis are also practically insignificant. In this case there are two bony projections between shaft and epiphysis, indicating that bony union of the two has begun, though the epiphysis itself is still immature. Undoubtedly, a certain

PLATE IX.

Skiagraph of knee from the inner side, showing the patella, the lower epiphysis of the femur, and the upper epiphyses of the tibia and fibula. The stronger and sharper shadow shows the outline of the condyle next to the plate; the fainter shadow the condyle away from the plate.

The upper epiphysis of the tibia showing the spine and tubercle on its articular surface, and the double epiphysial line from the epiphyses forming an angle with the line of the X-ray. Separate centre for the tubercle of the tibia.

Epiphysis of fibula showing through the tibia.

Exposure, four minutes.

growth and development of the epiphysis must go on even after union to the shaft has taken place.

The enlarged skiagraph of the carpus in Plate XIII shows us the carpal design drawn in strong lines.

HAND.

The hand lends itself so marvellously to the X-ray that we can expect to get here all the bony details it is possible for the X-ray to bring out, and the skiagraph of Plate VI shows us the substance as well as the shadow. Such a figure is preferable to that given by Gray, for we have all the fine internal structure. Also the figure showing the development of the hand could with advantage give way to a fine skiagraph of the parts. According to Gray, the shafts of all the metacarpal

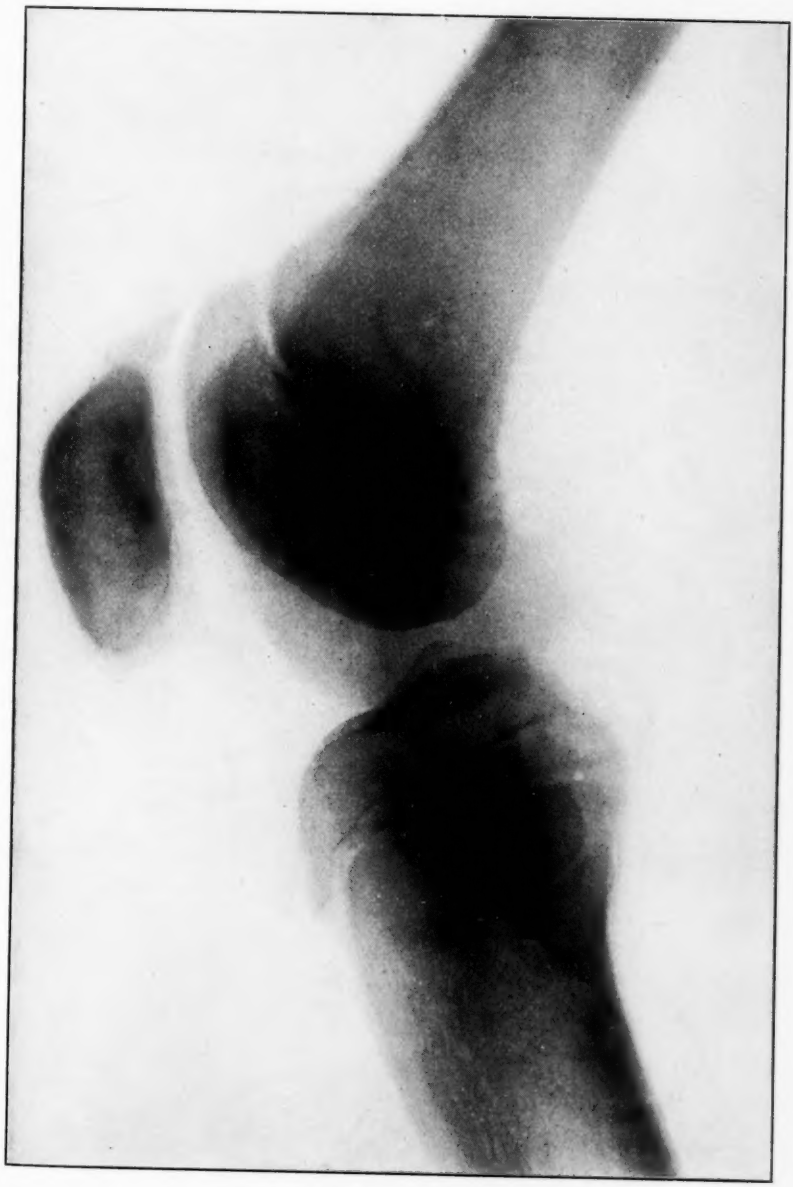


PLATE IX.

and phalangeal bones begin to ossify at the eighth week. The centres for the epiphyses of the metacarpals appear about the third year and unite about the twentieth, while the centres of the epiphyses of the phalangeal bones appear between the third and the fifth years and unite between the eighteenth and the twentieth years. Viewing the entire hand, it is evident that the so-called metacarpal bone of the thumb is a first phalangeal bone from a developmental point of view.

Hip.

The femur develops from five centres,—one for the shaft, appearing about the fifth week, one for the head of the bone, at the end of the first year, one for the greater trochanter, at the fourth year, one for the lesser trochanter, about the thirteenth or fourteenth year, and one for the lower extremity, which appears at the ninth month of fœtal life. These join the shaft by bony union inversely as their ossific centres appear, the upper epiphysis about the eighteenth year, and the lower about the twentieth. For a very complete description of the development of the femur, I must again refer the reader to Poland's work, and I shall quote from him sufficiently to help understand clearly the skiagraphic findings.

"The epiphysis of the head of the femur is developed from a single ossific centre appearing just about its centre,—that is, above and somewhat behind the attachment of the round ligament,—from the tenth to twelfth month after birth. This centre is often surrounded by a number of small osseous granules, especially at its upper part. The cartilaginous head is still connected at this period with the great trochanter by a thick layer or mass of cartilage. This layer or strip at the end of the second year is thin and hollowed out, and presents many small depressions caused by the upward extension and increase in size of the osseous shaft to form the neck of the bone. It is all that remains now of the original cartilaginous upper end of the femur, from which the head and great and lesser trochanters are developed. These are gradually separated away from each other by the growing neck, and subse-

quently increase in size quite independently of each other. The head passes upward and inward from the growth of the neck in that direction, whilst the great trochanter continues in the direction of the shaft. At this time, the end of the second year, the cartilaginous lesser trochanter is already widely separated from the other two cartilaginous epiphyses. By the end of the fourth year nearly the whole of the epiphysis of the head is osseous, and separated from the great trochanter. . . . . At the seventeenth year the epiphysis is entirely ossified, and appears about to join to the neck, but this is not finally accomplished until the nineteenth to twentieth year." [17]

The hip is the most difficult joint to X-ray properly, and tests to its utmost the efficiency of the apparatus and the skill of the operator. In the first place, it is difficult to get the bone close to the plate, and therefore to get sharp outlines; and, secondly, unless the vacuum in the tube is high and the X-ray

PLATE X.

Skiagraph of ankle from behind, coronal view, showing lower epiphyses of tibia and fibula, with the astragalus.
Outer edge of tibia seen through the fibula.
Exposure, three minutes.

penetration is great, it is difficult to overcome the density of the heavy muscles surrounding the joint, for the combined density of the muscle is almost as great as the density of the bone itself.

The position which gives the best result is with the greater trochanter as close to the plate as possible. To accomplish this, the subject must lean slightly to the side skiagraphed and with the foot everted. This position is made more comfortable for the patient by drawing the thigh away from the middle line. It is important that the line of greatest X-ray intensity from the platinum reflector should be directly over the head of the bone.

The skiagraph presented is a fairly good one, and all the important features are brought out. Here, again, the negative is superior to the print. The small ossific centre for the lesser

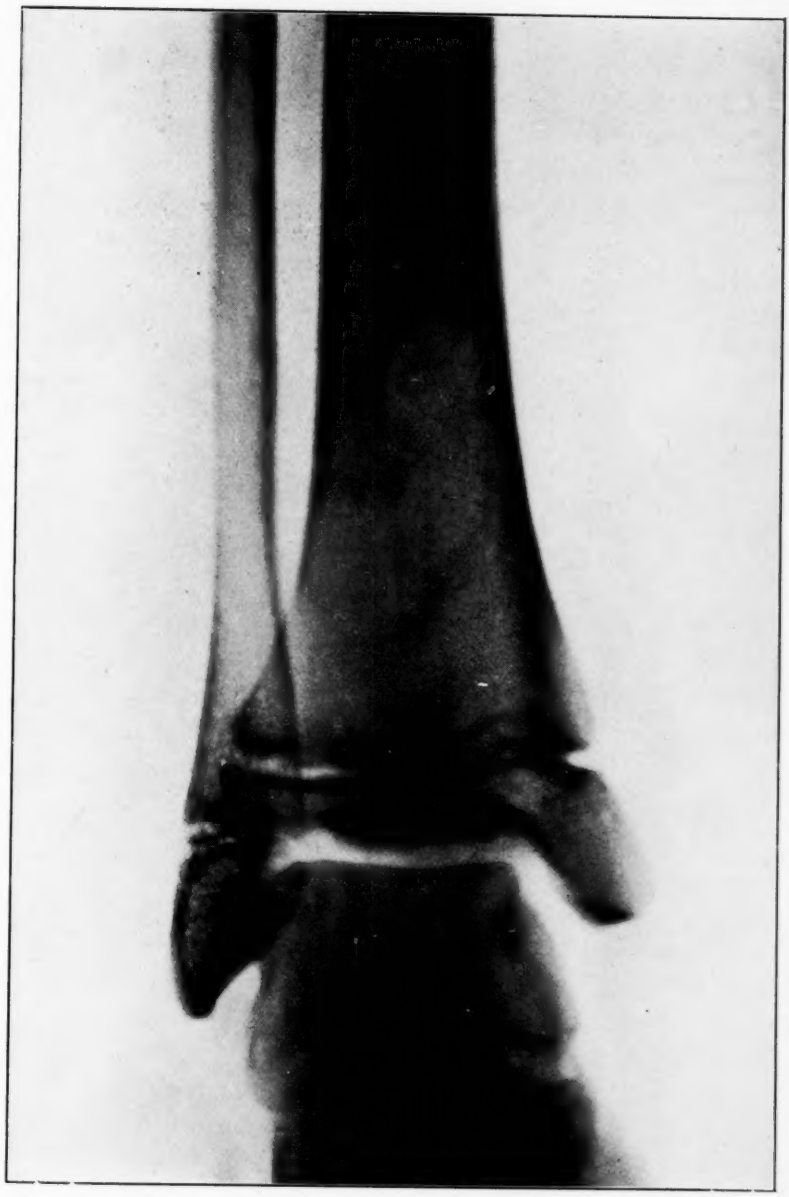


PLATE X.

trochanter is very distinct, somewhat in advance of the time specified by the books.

The great trochanter, by this time well ossified, is very distinct, with its epiphysial line separating it from the shaft. When the hip is taken with the subject lying flat on the plate, the foot being straight, this tuberosity comes out in profile, and its relations to the shaft are better seen. In this position, however, the head of the bone does not come out so well. When so taken, the line of greatest X-ray intensity should come more from the middle line of the body. This will bring out the epiphysis of the lesser trochanter and make the acetabulum more distinct.

The head of the bone is shown well ossified, and there is visible the epiphysial line separating the head from the neck, much better seen in the negative, however. The acetabulum is well differentiated, and the epiphysial line separating the ischium and pubis from the ilium.

Knee.

The knee-joint is a much simpler joint to understand, both from an anatomical and developmental stand-point. The lower epiphysis of the femur is the only one whose ossification begins before birth.[18]

Ossification advances rapidly, and there is soon formed a large and prominent epiphysis easily studied both in its anatomical and surgical bearings.

"At the sixteenth year this enormous epiphysis is separated by its cartilaginous lamina from the diaphysis, the extremity of which presents a mammillated rounded surface divided by a slight furrow, running in an antero-posterior direction and corresponding to the intercondyloid notch.

"The upper surface of the epiphysis is cup-shaped, with a central projection formed by the median centre of ossification and fitting into the furrow just mentioned on the diaphysis. Its anterior lip projects upward, overlapping the front of the diaphysis, and, like the articular surface, which it includes, projects higher on the outer portion. The cartilaginous line of

junction is at the outer portion of the anterior lip about one-eighth of an inch above the articular surface, and slopes downward towards the lateral aspect of the condyles, and thus presents a sinuous outline; behind it reaches the articular surface on each condyle and corresponds between these with the upper limit of the intercondyloid notch. The epiphysis is therefore seen to include the whole of the articular surface, both front and back." [19]

In the frontal view the X-ray well illustrates this description; the entire sinuous epiphysial line with the condyles and intercondyloid notch are all distinct.

According to the usual law, though the first to ossify, it is the last to join the shaft, uniting from the twentieth to

PLATE XI.

Skiagraph of ankle from the inner side, sagittal view, showing lower epiphyses of tibia and fibula, and the epiphysis of the os calcis.

The astragalus, the cuboid, the scaphoid, and the cuneiform are distinct with their internal structure.

Sagittal view of the proximal epiphyses of the metatarsals.

Exposure, three minutes.

the twenty-fifth year. At the age of thirteen it is seen to be fully formed, the largest epiphysis in the body, firmly united still by cartilage to the shaft, and requiring undoubtedly great force to separate it. The frontal view is best taken from behind, and the sagittal view from the inner side. This latter gives us the relation of the patella to the epiphysis and to the joint. By using a celluloid film, which can be adapted to the curved surface of the joint, we get a very striking though distorted skiagraph which brings out prominently the sinuous epiphysial line and the condyles. The condyles and intercondyloid notch are almost as distinct as in a drawing.

In the sagittal view the condyle away from the plate is but a faint though sharp shadow, be it noted; a striking example of the distortion produced by the different distances of the different points of an object from the plate. The condyle next to the plate is sufficiently close to give us practically the

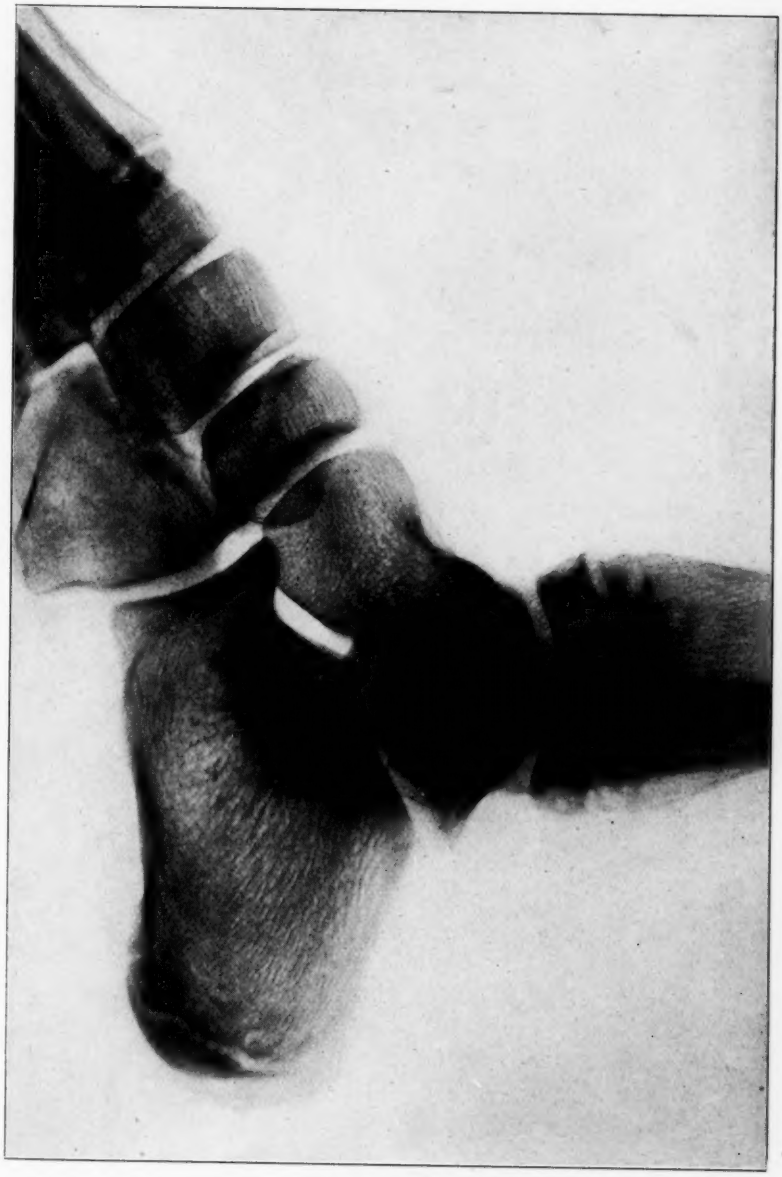


PLATE XI.

exact size of the bone. In the frontal view taken from behind, the bone is not so close to the plate and the shadow is somewhat larger. The bone can be brought somewhat closer to the plate anteriorly, but the patella must be pushed to one side, and the bones are somewhat at an angle. The patella appears as a faint shadow. A good deal of the texture of the bone can be brought out.

The upper epiphysis of the tibia is cartilaginous at birth, but a centre of ossification appears any time from two weeks up to the twelfth month. Gray places it at birth; as already mentioned, it may appear even before birth. The expanded epiphysis with its tuberosities rapidly ossifies. The tubercle of the tibia is an extension downward of the epiphysis. According to Béclard and Sappey, it is often ossified by a separate centre, as in the lower animals.[20]

In the negative of the sagittal view the tubercle is seen as a separate ossific centre; the bony growth downward from the epiphysis is also plainly seen, indicating that the two centres grow towards each other. The strong ligamentum patellæ is also very distinct. Unfortunately, in the printing, an exposure sufficient to bring out strongly these finer details over-exposes the rest of the print. This is the most difficult thing to overcome in printing from highly intensified negatives; certain fine points have to be sacrificed in bringing out the details in the body of the bone. By the fourteenth or fifteenth year this epiphysis is practically completely ossified. According to Gray, it joins the shaft about the twentieth year; according to Poland, from the twentieth to the twenty-second year, and even as late as the twenty-third year.[21]

The X-ray findings are best seen in the frontal view; the upper articular surface with its spinous process and tubercle on each side being beautifully shown. The epiphysial line is much more distinct than in the femur. In the sagittal view, the epiphysial junction not being in line with the X-ray, gives the appearance of two epiphysial lines. Of course, the frontal view dispels this seeming aberration. In the negative all the parts are most beautifully shown. In the print we get

a faint indication of the growth downward from the epiphysis to form the tubercle of the tibia. In the frontal section we can see only the base of this process with its characteristic beak.

The upper epiphysis of the fibula is cartilaginous at birth, and it is only four or four and a half years later that the first osseous granules appear, forming a distinct centre between the fifth and sixth year (Poland). According to Gray, this centre appears about the fourth year, uniting with the shaft about the twenty-fifth year. Bland writes, "This epiphysis joins the diaphysis about the twentieth to the twenty-second year; its union may be delayed as late as the twenty-fifth year." [22]

By the X-ray this epiphysis is best seen in the frontal view. At the age of thirteen it is already well ossified, al-

PLATE XII.

Skiagraph of foot from the anterior surface, coronal view, showing the epiphyses of all the bones of the toes.

The scaphoid, cuboid, and three cuneiform bones of the tarsus.

Exposure, two minutes.

though it is evidently still immature. There is no styloid process, there are no sharp bony outlines, and no close contact with the tibia. In one skiagraph taken the epiphysis appeared entirely free from the tibia, and even in this plate the two bones but just touch. In the sagittal view it is seen through the tibia apparently, the outlines being very distinct in the negative, less so in the plate. In a light print it is of course better seen.

Ankle.

The ankle-joint offers to the X-ray no difficulties in shadowing its component parts. We get a very striking picture of its two epiphyses in a frontal view, taken with the plate on the anterior surface, the foot being extended to its full limit. You get about as good results posteriorly, the tendo Achillis resting on the plate. In the sagittal view, while the composite shadow of tibia and fibula is clear enough, the epiphyses are not so strikingly shown, but the

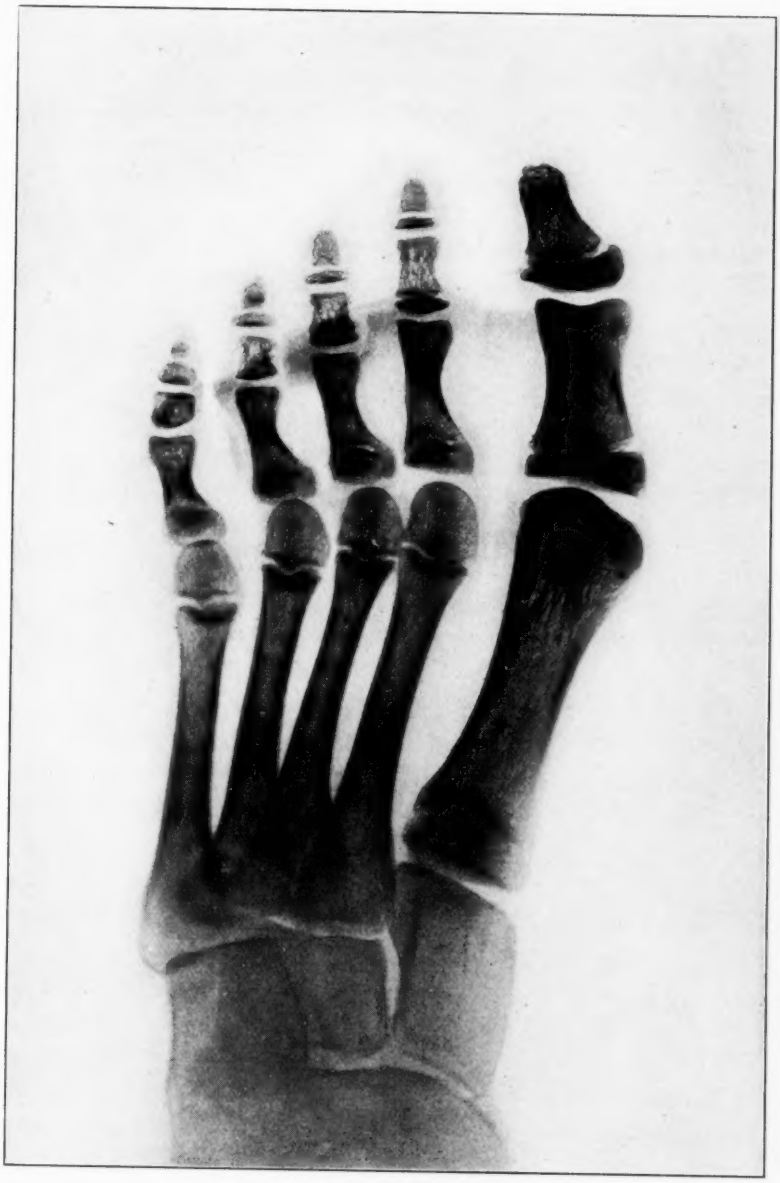


PLATE XII.

ankle, as a whole, is better seen, and at the same time we get the os calcis with its epiphysis.

The lower epiphysis of the tibia appears about the eighteenth month; it ossifies rapidly, the ossification extending into the malleolus by the end of the second year. By the fourteenth or fifteenth year the epiphysis is completely ossified. It unites to the shaft at the eighteenth or nineteenth year (Poland).

Béclard has described one case seen by him where there was a special centre for this malleolus, evidently a very rare occurrence.

In the skiagraph, frontal view, the two epiphyses are beautifully shown; the epiphysial lines very distinct, the cartilages being still quite thick, and the two malleoli well advanced in ossification. The tibia, showing through the delicate fibula where they overlap, gives a striking appearance to the picture. You see here, too, the exact relationship of these two bones to the astragalus. In the sagittal view, the epiphysis of the tibia comes out better than that of the fibula. The thick astragalus having to be reckoned with, the composite shadow is not so translucent.

The centre of ossification of the lower epiphysis of the fibula seems to vary greatly in the time of its appearance; according to Poland, any time from the eighteenth month to the end of the third year. It is completely ossified by the eighth or ninth year, and joins the shaft from the nineteenth to the twenty-second year. This epiphysis appears before the upper one, though the nutrient artery runs downward, being thus an exception to the rule. It, however, follows the rule by uniting first to the shaft.

In the skiagraph two points are very noticeable and worthy of mention, the fibular malleolus is larger than the tibial, and is much lower. Mr. J. Bland Sutton has called attention to the fact that this malleolus extends lower in man than in the higher mammals. Man's erect position must explain this, the malleolus helping greatly to strengthen the ankle.

FOOT.

According to Gray, the epiphysis of the os calcis appears about the tenth year and unites after puberty. It is completely ossified by the thirteenth or fourteenth year.

In the skiagraph it is evidently well ossified, forming a very characteristic cap to the bone. It is best brought out when skiagraphed from the inner side. The spongy texture of the tarsal bones is beautifully brought out, being especially fine in the negative.

The foot offers the same fascination for X-ray work as the hand on account of the sharp and minute details brought out. Here the print does more justice to the negative, and with a magnifying-glass we can marvel at the microscopic details which the X-ray reveals. Through the magnifier we get something of a stereoscopic effect, the shadow and the substance in one.

The osseous centres for the shafts of the metatarsal and phalangeal bones appear from the seventh week to the second and even to the fourth month. The centre for the proximal epiphysis of the metatarsal of the big toe appears about the fifth year. The centres for the distal epiphyses of the remaining metatarsals appear about the third year. The centres for the phalangeal epiphyses appear from the fourth to the sixth and even to the seventh year. They all unite from the seventeenth to the twentieth year.

The skiagraph speaks for itself; it was taken from the anterior surface. It could well replace the diagram given in Gray to show the schema of the development of the foot.

It is noticeable that in the terminal phalangeal bones of the four smaller toes the epiphyses are almost as large as the bones themselves, while in the little toe the epiphysis is actually larger than the terminal bone. Again, in the second phalangeal row the bone for the little toe and that for the toe next to it have apparently no epiphyses.

The two sesamoid bones of the big toe are seen as dark shadows through the head of the metatarsal bone. They are at this age well developed.

REFERENCES.

[1] "An X-Ray Study of the Normal Movements of the Carpal Bones and Wrist." Reprinted from Proceedings of the Association of American Anatomists, 1898.

[2] "Traumatic Separation of the Epiphyses." By John Poland, F.R.C.S., with 337 illustrations and skiagrams. London: Smith, Elder & Co., 15 Waterloo Place. 1898. Pp. xxxi-926.

[3] I have just had brought to my notice a paper in the *Deutsche Zeitschrift für Chirurgie,* for January, 1900, by Dr. Oscar Wolff, entitled, "Ueber traumatische Epiphysenlösungen," which is a model of scientific excellence and is well worthy of careful study. The many skiagraphs illustrating it have been made diagrammatic to bring out the salient features.

[4] Op. cit., page 157.

[5] Op. cit., page 163.

[6] Op. cit., page 164.

[7] Op. cit., page 262.

[8] Op. cit., page 263.

[9] Op. cit., page 264.

[10] Op. cit., page 266.

[11] Poland, op. cit., page 457.

[12] Op cit., page 458.

[13] Op. cit., page 471.

[14] Op. cit., page 470.

[15] Op. cit., page 580.

[16] Op. cit., page 478.

[17] Op. cit., pages 615, 616.

[18] Poland states that occasionally an ossific centre appears before birth in the upper epiphysis of the tibia.

[19] Op. cit., page 678.

[20] Poland, op. cit., page 798.

[21] Op. cit., page 799.

[22] Op. cit., page 856.

A CONTRIBUTION TO THE STUDY OF INTRA-ABDOMINAL OMENTAL TORSION.

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The subject of intra-abdominal omental torsion has only very recently been brougth to the attention of surgeons. The credit for having first reported a case of omental torsion occurring in a hernial sac belongs to Max Oberst, of Volkmann's Klinik.[1] In 1882 Oberst operated on a right inguinal hernia of twelve years' standing that had suddenly become irreducible. He found a torsion of the omentum, the cause of which was probably repeated forcible attempts to reduce the hernia. Oberst thought it possible that a loop of intestine had prolapsed into the hernial sac, and that violent peristalsis had aided in bringing about the torsion.

A second onward step in the study of intra-abdominal omental torsion was taken by Professor Maydl,[2] of Prague, in 1895. Maydl's communication was entitled "Ueber Retrograde Incarceration der Tuba und des Processus Vermiformis in Leisten und Schenkelhernien." Although Maydl only reported retrograde incarcerations of the Fallopian tube and of the vermiform appendix, he really paved the way for the subsequent reports of retrograde omental incarceration. To explain what is meant by retrograde incarceration, Maydl takes the Fallopian tube as an example. Retrograde incarceration of this cordlike organ can take place when it passes three times through the constricting opening (hernial ring); *i.e.*, when the uterine end of the tube is within the abdomen and the fimbriated end lies outside of the constricting ring in the



FIG. 1.—A is the pedicle which connected the tumor with the remainder of the omentum. The torsion of the pedicle can still be seen. At B there was an adhesion to an appendix epiploica of the ascending colon, near the hepatic flexure.

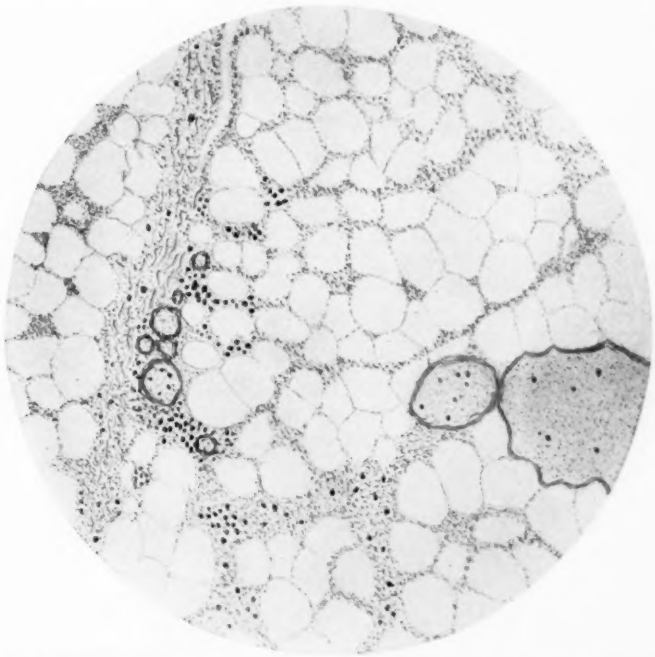


FIG. 2.—Author's case, magnified 100 times. There is some increase in connective tissue, with exudation of blood cells. The veins are dilated and filled with blood.

hernial sac. Naturally there is then within the abdominal cavity a loop of the tube which is incarcerated. This Maydl called " retrograde incarceration."

Shortly after the report of Maydl, Kukula [3] was fortunate enough to have a case of retrograde incarceration due to a pedunculated tumor of the small intestine in a patient of seventy-one years.

In the following year, 1896, Schnitzler,[4] of Vienna, presented the first case of retrograde incarceration of the omentum. The case was diagnosed as an irreducible femoral hernia.

The patient was a man of thirty-five years, in whom the hernia had suddenly increased in size and become irreducible. The part of the omentum in the hernial sac was in the shape of a sling, so that one could feel between the loops of the sling in the same manner as between the loops of an intestinal hernia. To the inner side of the hernial ring there was a thick clump of omentum in a state of beginning gangrene; it was adherent to the anterior abdominal wall,—*i.e.*, intra-abdominal,—while the incarcerated portion was perfectly healthy. The explanation of the fact that the part of the omentum in the hernial sac showed only slight circulatory changes, while the part in the abdomen showed marked changes, lies in the slinglike arrangement of the omental hernia. By this arrangement the intra-abdominal portion was peripheral, and its nutrition was in consequence most interfered with.

A new impetus was given to this subject by the report, in 1898, of Professor Carl Bayer,[5] of Prague, of a case of *retrograde omental incarceration with torsion of the pedicle.* This case was unique, and combined the points of interest of Bayer's case (omental torsion) and Schnitzler's case (retrograde omental incarceration).

Bayer's patient was a woman fifty-four years old, who had a left inguinal hernia since her last confinement, fifteen years previously. The hernia had always been reducible. The day before Bayer saw his patient for the first time she had a severe attack

of coughing. This was immediately followed by severe pain in the hernia, and the patient had the feeling as if a round object were revolving inside of it. She had slept poorly, and had pain even in the recumbent position. On examination the following morning, Bayer could find no signs of incarceration; the bowels had even moved on that day. Examination of the region of the hernia failed to reveal a tumor. It was only on examining the inguinal canal itself that the patient complained of pain. On the following day, however, a distinct tumor could be seen and felt in the inguinal region. The patient had been nauseated



FIG. 3.

several times since the first examination. The operation was now undertaken. It revealed the omentum with a pedicle twisted four or five times upon itself within the abdominal cavity (outside the hernial sac). The peripheral end of the omentum, the real tip, was pushed back through the inner (median) half of the hernial opening into the abdominal cavity; here its knoblike end was swollen, brownish black in color, and almost gangrenous. Even beyond the point of torsion the afferent omental vessels showed marked changes; thrombosed veins could be seen and felt. The pedicle was twisted to the thickness of a finger. The omentum

was adherent to the neck of the hernial sac by a band. This was one point of support; the other point of support was the intra-abdominal pedicle of the omentum. Around these two points the omentum was revolved just as a triangular handkerchief that is held at two ends could be. The circulation is thus interfered with; there is congestion, swelling, œdema. The patient had said that the attack of coughing was followed by severe pain in the hernia and the feeling as if a round object were revolving inside of it. This was certainly the torsion of the omentum which Bayer thinks was due to the attack of violent coughing. The free end of the omentum may have been pushed back into the abdominal cavity by the last act of torsion, or it may have been pushed back by the continually increasing œdema of the omentum resulting from the torsion. Once it was back in the abdominal cavity it continued to increase in size, owing to the progressive œdema, until it filled the whole remaining space of the hernial opening, and continued to increase in size beyond the opening, *i.e.*, in the abdominal cavity, so that it could no longer return to the hernial sac.

The next case of omental torsion was reported by Baracz,[6] of Lemberg, in February, 1900.

The patient was a man of forty-two, who for several years had had a reducible left inguinal hernia, the size of a goose's egg, for which he wore a truss. On April 4, 1899, after lifting a heavy trunk, he was seized with severe pain in the left inguinal region, and his hernia became larger, harder, and irreducible. After that the patient was confined to his bed. During the night of April 6 the pain in the inguinal region diminished, but severe abdominal pain, coming on in paroxysms, set in. The bowels moved on the 6th and twice on the 7th; after the morning of the 7th no more flatus was passed. Baracz examined the patient on April 7, at 4 P.M., and found the following condition:

Pulse, 120; temperature, 101½° F. The left inguinal region is a little prominent. The right testis is small, soft, and atropic. The left testis is considerably larger, harder, uneven, and somewhat tender. Extending upward from the left testis there is a very tender, hard strand running along the inguinal canal; it can be moved laterally, but cannot be returned into the abdomen. The abdomen is distended and tympanitic; there is

dulness in the flanks, which disappears on changing posture, showing the presence of free fluid. Operation showed a much thickened hernial sac. Its contents consisted of a clear fluid, and a hard strand, twelve centimetres long (of the thickness of a finger), turned five or six times on its axis, bluish-black in color, and adherent to the base of the sac by a broad band. This strand admitted a finger alongside of it in the inguinal canal, and it was found that the strand terminated in an intra-abdominal tumor. Accordingly, the abdominal walls were incised upward ten centimetres. The strand was found to be in connection with a tumor the size of an ostrich's egg, consisting of several bluish-black tumors the size of hens' eggs. The tumor was interlaced with connective-tissue strands and thick dilated veins. In the abdominal cavity there was bloody serum. The tumor was composed of the lower part of the omentum very much thickened and turned several times around its axis, in consequence of which there was marked stasis and a bluish-black color. The twisted pedicle of the omentum was very thin; above the point of torsion the omentum was normal. The tumor after its removal weighed one kilogramme. On section it consisted of islands of fat separated by connective-tissue walls in a state of marked congestion, and in places there was extravasation of red blood-cells, similar to the picture of a hæmorrhagic infarct. The arteries and veins were dilated *ad maximum* and stuffed with blood-corpuscles.

Baracz says his case is noteworthy because at the time of operation there was no true incarceration, as the lower twisted strand was movable in the hernial sac, and because the torsion took place high up in the abdominal cavity. The questions are whether the intra-abdominal torsion of the omentum (fixed by a band to the hernial sac) alone produced the symptoms of incarceration, and how the torsion took place. Baracz explains the origin of the torsion in the following manner. There was an old omental hernia adherent by a strong, thick strand to the hernial sac. The lower part of the omentum must have been very rich in fat and hypertrophic, partly filling the sac. The hypertrophy was probably caused by irritation of the truss and daily manipulation of the hernia for its reduction.

The tendency to torsion or partial torsion of the omentum must have existed for a considerable length of time, also in consequence of the daily manipulation. As this torsion was only partial, and as the blood supply to the partially twisted omentum was ample, the patient suffered little or no inconvenience therefrom. On lifting the heavy weight (three days before the operation) the hypertrophic mass of omentum which filled the hernial sac was twisted more forcibly around the strand, which acted as a cord; the blood supply of the twisted omentum was thereby cut off, and there followed complete stasis and thrombosis. The conditions of the adherent omentum in the hernial sac are now similar to those that exist when you attach a weight to an angle of a triangular cloth of which you are holding the other two angles. If, now, you impart a motion of rotation to the weight with the part of the cloth between the two hands as an axis, the weight readily drops to the opposite side of the axis. The two ends of the axis thereby are twisted, just as in this case the strand by which the omentum was adherent to the hernial sac was twisted. The subsequent torsion must have been accomplished by abdominal pressure. It was only after rest in bed that the omental mass was able to slip back into the abdomen.

This case is similar to Bayer's, but in Bayer's case the greater part of the omental tumor lay in the hernial sac; whereas in Baracz's the whole omental tumor slipped back into the abdominal cavity. In the latter case the omentum did not slip back into the abdomen at the beginning of the symptoms of incarceration (when the heavy trunk was lifted), and the torsion did not take place inside the abdomen; because the patient distinctly stated that immediately after lifting the weight, when the pain set in, the hernia became larger than usual and irreducible. So it must be assumed that the torsion took place in the hernial sac, and that later, after rest in bed, the omental tumor slipped back into the abdomen.

Dr. Charles H. Peck,[7] of this city, presented a specimen of omental torsion before the Surgical Section of the Academy of Medicine in February of this year.

To quote from the report in the *Medical Record:* "The tumor was made up of the entire omentum. This had been found rolled up in a vertical direction, and filling the right side of the abdomen from the umbilicus down to the pelvis. It projected behind the uterus and to the right, and pressed well into the anterior fornix of the vagina. The woman gave a history of having been in her usual health up to four or five days prior to her admission to the French Hospital. She had then been attacked suddenly with abdominal pain and vomiting, associated with a moderate rise of temperature. On admission the temperature had been 100.5° F., and a mass could be made out indistinctly in the abdomen. On performing abdominal section this solid tumor had been found. About two inches below the transverse colon a very tightly twisted pedicle had been discovered. This had proved to be the entire upper portion of the omentum twisted around the vertical axis. The symptoms had evidently begun when the strangulation of this portion had been produced by the twisting." In reply to a letter of mine, Dr. Peck kindly furnished me with the following additional data of his case: "My case of omental torsion did have a small reducible hernia (inguinal) on the right side of twelve years' standing. There was nothing in the sac at the time of the operation, and the omental mass was not apparently connected with it in any way. There were some old adhesions around the right tube and ovary with which the omental mass lay in contact. There was no tumor tissue in the mass; sections showed simply chronic inflammatory changes, with venous engorgement, and the extravasation of beginning strangulation."

The most recent case was reported by Professor Hochenegg,[8] of Vienna, in March, 1900.

The patient, a man forty-one years old, had been suddenly seized two days before with severe abdominal pains, nausea, vomiting, and a chill lasting half an hour. An enema resulted in a stool, but gave no relief. The following morning there was less pain, vomiting had ceased, and some flatus had been passed; the temperature was 101° F. The next day the condition was worse. The patient was restless, the pulse rose to 100, the abdomen was distended, and singultus set in. The patient had been born a right-sided cryptorchid. During his youth the testicle descended outside of the inguinal ring and a hernia followed it.

A truss had been worn, but the hernia increased to more than the size of a goose's egg. As the scrotum on that side was undeveloped, the hernia lay under the skin in the inguinal region; it was always reducible. With the exception of the hernia, the patient was well and strong until two years ago. At that time gastric disturbances set in, with sensations as if the stomach were being pulled aside by a heavy weight. Various "cures" were ineffectual, and since then the patient's stomach has been sensitive; in consequence he was depressed and has not felt entirely well. Twenty-four hours before his acute symptoms set in, *i.e.*, three days ago, while in a bath, the hernia suddenly became larger, and could only be reduced with the greatest difficulty after considerable forcible manipulation. The truss was then applied, and everything seemed normal until twenty-four hours later, when the above-mentioned serious symptoms began to manifest themselves. Examination showed an apathetic man, with a small pulse, superficial and rapid respiration, and an occasional singultus. The evening temperature was 101½°. The patient was anxious not to move, kept the right thigh flexed, and would only slowly and carefully extend it. The whole abdomen was distended and tense; the inguinal hernia could only be retained with the truss. The hernial sac as well as the inguinal canal were empty. On introducing the finger into the canal, an impulse could be obtained on coughing. From this examination it was concluded that the hernia was not the origin of the trouble. On examination the whole abdomen was found distended. In the right inguinal region, about a hand-breadth above Poupart's ligament and extending outward into the flank, a distinct mass could be felt extremely tender and dull on percussion. No peristalsis could be observed. The diagnosis was then made of appendicitis with a localized exudate. Operation was postponed to observe the development of the case. During the night morphine was given for the pain. The next morning the temperature was subnormal (97.6° F.), the pulse was small (96), there was decided icterus, the abdomen was more distended, and the tender resistant mass on the right side had increased to the size of a man's head. The point of greatest tenderness was now over the gall-bladder. There was no vomiting, but frequent singultus. The examination of the hernial sac (the truss had been taken off) showed it to be distended, distinctly

fluctuating, and extremely compressible; on relaxing the compression it immediately refilled. From this it was deduced that there was a peritoneal exudate which was forced into the hernial sac by intra-abdominal pressure. An incision was then made in the right mammillary line over the greatest convexity of the tumor. On opening the peritoneal cavity a large amount of bloody serum flowed out (about two litres); then a bluish-black tumor with dilated veins, which was recognized as omentum, appeared. The tumor was of the size of a man's head and was nowhere adherent. On the tumor, deposits of fibrin and grayish-white discolorations, especially on the peripheral portions of the omentum, were noticed. To enable it to be accommodated, the enormously swollen omentum was to a certain extent doubled on itself and tucked in above, and the whole mass was fixed together by loose adhesions. As the cause for this peculiar change in the omentum, Hochenegg suspected a torsion. On inspecting the upper portion of the omental mass, he found a slender pedicle twisted upon itself three times from right to left; above this strand, which formed the only connection of the tumor, the omentum was perfectly normal.

Hochenegg regards his case as unique. He attempts to explain the torsion by the fact that the hernia was congenital, and that omentum frequently descended into the hernial sac. By this dragging down of the omentum, a portion became thinner, drawn out; in other words, a pedicle was formed. The lower portions of the omentum, *i.e.*, those that often prolapsed into the hernia, became thickened and clumpy, just as we often see in old omental hernias. These heavy omental masses pulled and tugged on the pedicle which joined them to the rest of the omentum until there was finally only a thin pedicle, and the free non-adherent tumor composed of the omentum and the portion in the hernial sac. Two prime factors in bringing about a torsion were then present,—the long pedicle, and the free non-adherent tumor composed of the hypertrophic omentum. The next factor in the production of the torsion we find in the history. The hernia suddenly became larger, and the patient had to use violent efforts of various kinds—pulling, pushing, twisting—before he could

reduce it. These manipulations probably caused the first twist in the pedicle. The successive twists were due, as is usual in intra-abdominal free tumors, to the changing pressure of surrounding organs, to the progressive swelling and œdema occasioned by the partly twisted pedicle, to the jolting in walking and pressing, and to the various other causes first accurately described by Rokitansky in connection with ovarian tumors. After the torsion had taken place, the same symptoms followed as in torsion of other organs,—the initial chill, the initial vomiting (reflex irritation of the peritoneum), the continually increasing tension of the abdomen, the collapse, and the disturbed general condition. The most striking symptom was the transformation of the former contents of the hernial sac into an enormous tumor. This rapid increase in volume was due to congestion and œdema, just as we see an ovarian cyst, under similar circumstances, increase in size. The bloody peritoneal exudate was also due to the circulatory disturbance. The extreme rarity of the disease Hochenegg pleads as an excuse for the wrong diagnosis.

The cases that I have reported above are all that I have been able to find in the literature. Only four of them (Bayer's, Baracz's, Peck's, and Hochenegg's) are cases of intra-abdominal omental torsion, and in only one case, Peck's, was the phenomenon not the result of a pre-existing hernia. But in Peck's case the tip of the omentum lay in contact with an adherent right tube and ovary.

My own case was the following:

A. L., seventy-nine years old, entered Mt. Sinai Hospital, March 7, 1900. He was referred to the hospital by his physician, Dr. M. R. Richard, with the diagnosis of an abscess following appendicitis. The patient, in spite of his advanced age, had always been active and enjoyed good health. On July 3, 1899, he was knocked down by an electric car. He fell face downward and had his chin cut open. He was unconscious one hour, but, so far as he knows, sustained no internal injury. There was a right-sided inguinal hernia of thirty years' standing; it was always reducible, never painful, and never larger than a small

fist. About four weeks ago, without discoverable cause, patient was suddenly seized with severe pain in the right iliac region. This attack lasted twenty-four hours, and then subsided. Following the attack, the patient was perfectly well and able to attend to his affairs. Four days before the operation the man was again suddenly seized with severe pain in the right iliac region; the pain was cramp-like in character, and was not accompanied by vomiting or by fever. The pain continued at intervals until he entered the hospital. The bowels had moved regularly. Examination showed a well-nourished, rather fat old man. The lungs were the seat of emphysema and bronchitis, the heart of a myocarditis. The liver and spleen were normal. The abdomen was soft and not tympanitic. About midway between the anterior superior spine of the ilium on the right side and the free border of the ribs, extending from the axillary to the mammillary line, a rounded tumor of the size of an orange was readily felt. It was tender to the touch, of a doughy consistency, and dull on percussion. The rest of the abdomen was free from pain. The sac of the inguinal hernia on the right side was empty. Temperature, 101.4° F.; pulse, 100; respiration, 24. I made a diagnosis of an intra-abdominal abscess. Owing to the condition of the man's heart and lungs, I operated under nitrous oxide anæsthesia. A vertical incision was made over the tumor, the centre of the incision being at the level of the umbilicus. The incision was deepened through the oblique muscles and the peritoneal cavity opened. At the site of the tumor that had been felt, a piece of omentum as large as the palm of the hand was found. It was very much infiltrated and dark-blue in color. Its distal portion was adherent to an appendix epiploica on the ascending colon; its proximal portion was continuous with the remainder of the omentum by a narrow pedicle, which was twisted upon itself five or six times, causing strangulation of the portion of the omentum affected. The strangulated portion of the omentum, besides being adherent to the ascending colon near the hepatic flexure, was adherent to the abdominal wall (local peritonitis). Some of the adhesions were broken down, others tied off, and the pedicle above the strangulated portion carefully ligated. The strangulated mass was then cut away. A small drain was introduced and the wound closed with through and

through sutures. The temperature remained normal and primary union resulted.

The case is of considerable interest not only on account of its extreme rarity, but also from an etiological stand-point. As stated above, I have been able to find but one case of omental torsion not associated with a hernia; and in that one case the omentum was in contact with an old inflamed tube and ovary. As a case of intra-abdominal omental torsion not associated with the pelvic organs or with a hernia, my case is, I believe, unique. It is true that my patient had a hernia on the right side, but it was always small and always reducible. And, moreover, the strangulated portion of the omentum was located high up in the abdomen, so that it is very doubtful if that portion had ever been located in the hernial sac. If it was never inside the sac, how was the pedicle formed? Was the accident of eight months previous an etiological factor in the formation of the pedicle? Even granted we can explain the formation of the pedicle, it is difficult to account for the strangulation. As Bayer and Baracz pointed out in reporting their cases, we expect to have two points of support around which the omentum can revolve in order to produce the strangulation. The one point of support in our case was the pedicle of the omentum, and the other point the adhesion between the tip of the strangulated portion of the omentum and an appendix epiploica on the ascending colon. I believe that this adhesion was formed during the attack of pain which the patient had four weeks before his entrance to the hospital. What caused this attack I am unable to say. There may have been an inflammatory process going on in the patient's colon at that time which was the cause of it. We now have two of the requisites for the production of a torsion,—a pedicle which acted as one point of support, an adhesion to the colon which acted as a second, and between these two points the mass of omentum which was to become strangulated. Now, finally, what caused the torsion that resulted in the strangulation? There was no violent coughing, no accident, no manipulation at reduction as seen in the hernia cases; in short, no etiological factors

whatever. It is possible that peristalsis of the colon, after the omentum became adherent to it, contributed to the twisting of the pedicle. Once the torsion had taken place, it is easy to account for the swelling, œdema, and local peritonitis which caused the omentum to become adherent to the abdominal wall. It is also easy to see how the pathological process would have continued and resulted in gangrene of the affected omentum and general peritoneal infection.

The following table comprises all the cases of omental torsion that have been reported; it includes those in which the torsion took place in a hernial sac, as well as those in which some part of the omentum was adherent to the hernial sac.

No. 1.—*Operator and date,* Max Oberst, of Volkmann's Klinik, 1882. Thirty-five years. Male. *Was hernia present, and how long?* right inguinal hernia, twelve years. *Was omentum in connection with the hernia?* yes. *Probable etiology,* forcible attempts at reduction. *Diagnosis made before operation,* irreducible inguinal hernia. *Duration of symptoms,* two days. *Pathological condition.* Turbid fluid in the sac; incarcerated omentum due to torsion, entirely within the hernial sac.

No. 2.—*Operator and date,* Julius Schnitzler, of Vienna, 1896. Thirty-five years. Male. *Was hernia present, and how long?* femoral hernia, several years. *Was omentum in connection with the hernia?* yes. *Probable etiology,* retrograde incarceration. *Diagnosis made before operation,* incarcerated femoral hernia. *Duration of symptoms,* twenty-four hours. *Pathological condition.* Beginning gangrene of omentum, adherent to anterior abdominal wall; no true omental torsion.

No. 3.—*Operator and date,* Carl Bayer, of Prague, 1898. Fifty-four years. Female. *Was hernia present, and how long?* left inguinal hernia, fifteen years. *Was omentum in connection with the hernia?* yes. *Probable etiology,* severe attack of coughing. *Diagnosis made before operation,* strangulated inguinal hernia. *Duration of symptoms,* two days. *Pathological condition.* Beginning gangrene of omentum; torsion and retrograde incarceration.

No. 4.—*Operator and date,* Baracz, of Lemberg, February, 1900. forty-two years. Male. *Was hernia present, and how long?* left inguinal hernia, several years. *Was omentum in connection with the hernia?* yes. *Probable etiology,* lifting heavy trunk and attempts at reduction of the hernia. *Diagnosis made before operation,* strangulated inguinal hernia. *Duration of symptoms,* three days. *Pathological condition.* Clear fluid in hernial sac; bloody serum in abdomen; tumor of strangulated omentum weighing one kilogramme.

No. 5.—*Operator and date,* C. H. Peck, of New York, February, 1900. Thirty-seven years. Female. *Was hernia present, and how long?* right inguinal hernia, twelve years. *Was omentum in connection with the*

hernia? no. *Probable etiology,* unknown. *Diagnosis made before operation,* abdominal tumor. *Duration of symptoms,* five days. *Pathological condition.* Strangulation of greater part of omentum in contact with adherent right tube and ovary.

No. 6.—*Operator and date,* Hochenegg, of Vienna, March, 1900. Forty-one years. Male. *Was hernia present, and how long?* right inguinal hernia, thirty years. *Was omentum in connection with the hernia?* yes. *Probable etiology,* attempts at reduction of the hernia. *Diagnosis made before operation,* appendicitis, with peritoneal exudate. *Duration of symptoms,* three days. *Pathological condition.* Strangulation of omentum; bloody serum in abdomen.

No. 7.—*Operator and date,* Joseph Wiener, Jr., of New York, March, 1900. Seventy-nine years. Male. *Was hernia present, and how long?* right inguinal hernia, thirty years. *Was omentum in connection with the hernia?* no. *Probable etiology,* unknown. *Diagnosis made before operation,* intraperitoneal abscess. *Duration of symptoms,* four days. *Pathological condition.* Strangulated omentum adherent to abdominal wall and to ascending colon.

From this table it will be seen that omental torsion occurs more often in males than in females (presumably on account of the more frequent occurrence of inguinal hernia in men), that it is not met with in youth, and that it is found only in persons who have a hernia; although the diseased omentum is not always found in relation with the hernia. The portion of omentum affected may be small, or may be composed of almost the entire omentum. The etiology of the cases in which the omentum is not connected with a hernia is very obscure. In the other cases the etiology can generally be traced to forcible attempts at reduction of the hernia. In not a single case was the diagnosis made before operation. The cause for this is not far to seek. Not only are omental tumors extremely rare, but they have no characteristic symptoms; the symptoms they call forth are those produced by an abdominal tumor through its mechanical action. When the torsion takes place in connection with a hernia, the diagnosis is naturally made of an incarcerated hernia. In all of the cases the urgency of the symptoms was recognized, and a prompt operation was performed. There is a practical point of some value. If we cut down on a hernia that produced the symptoms of strangulation and find only a strand of omentum in the inguinal canal,

we should always investigate the intra-abdominal portion of the omentum to make sure that there is no torsion present there.

BIBLIOGRAPHY.

[1] Oberst, Max: "Zur Kasuistik d. Bruchschnittes nebst Bemerkungen über Netzeinklemungen." Centralblatt f. Chir., 1882.

[2] Maydl: "Ueber retrograde Incarceration d. Tuba u. d. Processus vermiformis," etc. Wiener klin. Rundschau, 1895.

[3] Kukula: Ueber retrograde Incarceration eines gestielten Tumors des Dünndarms." Wiener klin. Rundschau, 1895.

[4] Schnitzler: "Präperat von retrograder Incarceration des Netzes." Wiener klin. Rundschau, 1896.

[5] Bayer, Carl: "Retrograde Netzincarceration mit Stieltorsion über d. Bruchring." Centralblatt f. Chir., 1898, p. 462.

[6] Baracz: "Netzincarceration mit Torsion in d. Bauchhöhle." Deutsche Zeitschrift f. Chir., February, 1900.

[7] Peck, C. H.: "Specimen of Intra-abdominal Omental Torsion." Medical Record, March 3, 1900.

[8] Hochenegg: "Ein Fall intra-abdomineller Netztorsion." Wiener klin. Wochenschrift, March 29, 1900.

RETRENCHMENT OF LIPOMATOUS ABDOMINAL WALL COMBINED WITH OPERATION FOR RADICAL CURE OF UMBILICAL HERNIA.

By JAMES B. BULLITT, M.D.,

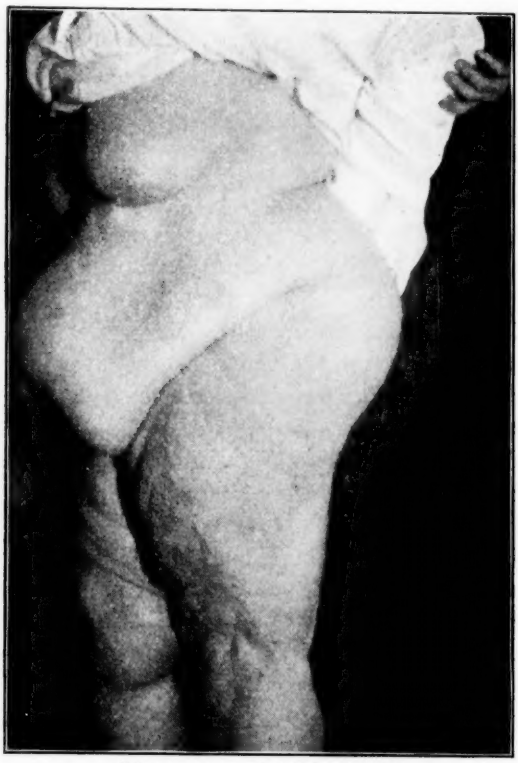
OF LOUISVILLE, KY.

THE patient was a woman of thirty-eight years, married, the mother of two children born respectively in her thirty-second and thirty-fourth years. She has always been very fat, at the age of sixteen weighing 246 pounds; at twenty years of age she weighed 260 pounds, the most she has ever weighed. Her present weight is about 240 pounds. She states that formerly, even when she was fattest, the abdomen was always flat. About one year ago the abdomen began to enlarge, enlargement taking place first straight up towards the breast on the right side above the navel. There was not much pain at first. The swelling of the abdomen gradually increased, with shortness of breath and great pain in the abdomen in front as well as in the back. In the last six months the abdomen has become much more prominent, half again as large as it was before. She had a fall from a wagon in September last, and since then there has been a discharge of a thin, brownish, ill-smelling fluid from the umbilicus. The bowels have been quite regular always, scarcely ever failing to act daily.

Physical Examination.—The pendulous abdomen hangs down like an apron on the thighs, being on a level with the perineum when the patient is in a dorsal position, and a couple of inches lower when in an upright position. In a standing position, the circumferential measurement of the base of the pouch is thirty-four inches; from side to side it is twenty inches, and from above downward, seventeen inches. Percussion shows the intestine close under the skin above the navel over an area five inches wide by two and a half inches vertically. On coughing, a very

pronounced impulse is felt in the contents of the pouch. The patient has observed that the tumor is much larger sometimes than at others. Diagnosis was made of umbilical hernia complicated by a very pendulous abdomen. The contents of the sac could be partially reduced.

In view of the excessive disability and discomfort which the patient suffered, it was determined to perform an operation for the radical cure of the hernia, and at the same time to retrench



Lipomatous abdominal wall.

the pendulous abdomen. The operation was performed on February 7, 1900, in the clinic of the Louisville Medical College, with the assistance of Dr. A. M. Cartledge. A transverse incision about six inches long was made two inches above the umbilicus, which had been previously stuffed with cotton and closed by means of three sutures. The hernial sac was encountered close to the skin, being covered by it and a thin layer of fat. The sac

was readily separated from its surrounding tissues down to its neck. It was then opened, exposing the hernial ring. This ring was about two inches in diameter, exactly in the central line; its borders were sharply marked by a thick fibrous ring which occupied the usual position at the upper part of the umbilicus. On opening the sac, it was found to contain a part of the transverse colon and omentum. The omentum alone was slightly adherent, but was not especially large and fat-containing, and, therefore, was not tied off. The intestine and omentum were easily returned through the ring. The edges of the ring could be readily brought in apposition, and closure was effected by mattress sutures taken from side to side through the base of the ring, closing it from above downward; a half-dozen heavy chromicized catgut sutures were necessary for this purpose. The sac was made up of the peritoneum on the inner side and the abdominal fascia on the outer, these two layers being amalgamated, inseparable, and forming one structure. The sac was then cut off about a half-inch from the margins of the ring, and a second running suture of No. 2 plain catgut was made, bringing the sac stumps together.

The abdominal wall contained a layer of fat from three to four inches thick. The horizontal incision which had first been made was now prolonged in both directions to the two flanks, and a second transverse incision was made about seven inches below the first and joining the ends of the first incision in the two flanks. These two incisions extended through the fat down to the fascia; the enclosed portion of the abdominal wall, amounting to several pounds of skin and fat, was now dissected up and removed in the shape of a wedge. A continuous catgut suture was now applied from side to side apposing the deeper portions of the exposed area. Above this, interrupted and buried catgut sutures were applied in tiers; and, finally, the skin was approximated by silkworm-gut sutures placed at intervals of several inches, and then a plain catgut suture applied in button-hole fashion. After suture the incision measured twenty-two inches in length from flank to flank. The retrenchment of the abdomen was very pronounced, the pendulous appearance being entirely removed and replaced by a simple, large, pronounced ridge.

On February 14 dressings were changed for the first time; primary union had taken place throughout. With the excep-

tion of the first night, when an annoying pain was complained of in the small of the back, the patient had practically no discomfort.

On March 5 the patient was exhibited to the Louisville Surgical Society. The abdomen, although very greatly reduced, was still somewhat pendulous; and it seemed rather a mistake that the retrenchment had not been made more extensive than it was. The hernia at this time gave no indication of recurrence; but, of course, the time is entirely too short to form any estimate of the ultimate success of the operation, in so far as the radical cure of the hernia is concerned.

The resection of the fatty abdominal wall in the way described constitutes a procedure of which I have not been able to find a description, though doubtless it has been done before. It seems to have several points of advantage. The incision down to the deep fascia is at right angles to the line of least resistance of the deep abdominal wall. Its extent gives full and ready access to the hernial sac and ring, and permits unembarrassed closure of the deeper structures. Most of all, perhaps, such resection rids the patient of a ponderous, distressing, and entirely superfluous abdominal pouch. If this case may be taken as an index, there need be no fear of failure, under proper conditions, of prompt union of even such an extensive incision through such a poorly vitalized structure as a fatty cushion of four or five inches.

It is a question for consideration whether or not such resection would be justifiable for the retrenchment of pendulous abdomens unaccompanied by hernia, for the purposes of promoting comfort and removing one, at least, of the causes tending to produce hernia.

The radical cure of umbilical hernia in adults has been so unsatisfactory that most writers still advise that the hernia should be retained by a pad if still reducible, and supported by a suspensory bandage if irreducible, radical cure only being attempted when operation is necessitated by strangulation. The unsatisfactory results are due to the great tension which attends the closure of the ring, it being impossible in many cases to appose at all the fascia constituting the margins of

the ring. The best results have been obtained by splitting longitudinally the inner margins of the sheaths of both rectus muscles and subsequent suture of the abdominal wall in layers, the peritoneum and overlying fascia being first united, then the two recti muscles, then the anterior sheaths of the latter, and, finally, the skin. This is the operation described by Tillmanns. It must be remembered, however, that in many cases it will be found impossible to unite the anterior sheaths of the rectus muscles after splitting in the way described, or at least such union would be possible only under great tension, which in all probability would defeat the ultimate success of the procedure.

It will be borne in mind that at the region of the umbilicus the sheath of the rectus muscle is made up in front of the aponeurosis of the external oblique and half of the aponeurosis of the internal, the other half, together with the aponeurosis of the transversalis muscle, forming the sheath posteriorly. It might be found possible to modify the operation detailed above by dividing the anterior sheaths of the rectus muscles vertically an inch or more from the ring borders. The strong fascia obtained in this way would then be turned over across the aperture, the inner sides of the flaps becoming the outer sides as they were sutured in place. The freed recti muscles could then be brought in apposition as before. Closure could be effected in this way without any tension. The wall over the recti muscles would be weakened; but as the rectus has here a posterior sheath, this weakening would not be serious.

[*June 20.*—The patient, writing under recent date, informs us that she is in excellent condition, able to attend to her household duties efficiently and comfortably, there being no evidence of recurrence up to this time.]

REPORT OF A CASE OF ACTINOMYCOSIS HOMINIS.

By JOHN CHADWICK OLIVER, M.D.,

OF CINCINNATI, OHIO.

The patient was forty-nine years of age, a jeweller by occupation. There was a history of carcinoma of the breast in the mother, and one sister died of cancer. No syphilitic history was obtainable. Twelve years previous to the present development, while undergoing a prolonged arsenical treatment, he developed a sore mouth, which healed very slowly. Six years later he inhaled the fumes of cyanide of potassium, and as a result suffered with a sore mouth for several months. Three or four years ago a small sore appeared near the left angle of the mouth. It was not in the vermilion border, but wholly on the mucous surface. This lesion presented a papillomatous appearance with slight ulceration surrounding it. There was no surrounding infiltration or induration. This spot healed after being curetted, but a white indurated patch occupied its former site. Two similar patches subsequently developed in the mucous membrane of the lower lip. These also healed after curettement, leaving similar scars to the one noted above. The patient was at this time suffering from a pyogenic process of the gums and teeth of the lower jaw.

About this time the purulent affection of the gums had progressed to such an extent as to lead his dentist to remove all of the teeth on the lower jaw except the last two molars on either side. A set of artificial teeth was made to replace those which had been extracted. A clamp for these teeth was attached to the second molars. The patient complained of the clamp on the right side making pressure upon the mucous membrane of the cheek.

In June, 1899, an ulcer made its appearance on the inside of the right cheek exactly opposite the location of the clamp. The ulcer rapidly enlarged in circumference. In six weeks it was

the size of a copper cent. The patient was advised to remove his artificial teeth. Although this was done, the ulcer continued to spread.

On July 2, 1899, the ulcer was curetted under cocaine anæsthesia, and the scrapings subjected to microscopic examination. This examination was negative, as was also a search for tubercle bacilli. The use of the sharp spoon was followed by a temporary improvement, but this was of but short duration. Dr. A. Ravogli saw the patient in consultation about this time. He regarded the lesion as being of a syphilitic nature. The patient was now put upon a course of potassium iodide in spite of the fact that a specific history was entirely lacking. The use of this remedy was persevered in for about two months, during which time iodism was well marked. The patient received no benefit from this medication.

While the patient was taking large doses of the iodide the ulcer extended, principally in a forward direction, until it reached the right angle of the mouth. For the first time the ulcer now became *very* painful,

By the end of September an enlargement began under the jaw, just in the region of the right submaxillary gland.

On October 7 the ulcer was thoroughly curetted while the patient was under ether anæsthesia. The submaxillary enlargement was so slight that it was supposed to be due to absorption from the ulcerated surface in the cheek; it was, consequently, not interfered with.

This curettement had no appreciable effect in checking the extension of the disease. The mass in the submaxillary region enlarged and became very hard. An enlargement now began in the neck in the vicinity of the angle of the jaw. This progressed rapidly and became very hard. The symptoms now seemed to indicate that the disease was epitheliomatous.

At this stage the patient asked to have another surgeon examine him. At his suggestion, Dr. E. W. Walker was called in. He gave it as his opinion that the disease was epithelioma, and advised a radical operation.

While the patient was considering the question of operation, the mass in the submaxillary region began to soften, and fluctuation soon became distinct. It was incised. A thin, greenish-yellow fluid containing some yellowish-white curdy masses was

discharged. This phenomenon led to the suspicion of an actinomycotic origin for the trouble, but microscopic examination failed to reveal the characteristic appearances.

The enlargement under the ear continued to increase. The point of incision in the submaxillary region became a sinus, from which a thin yellowish fluid containing the masses described above was discharged. They were examined microscopically on several occasions, and they were also stained for tubercle bacilli, but the results were negative.

The chief obstacle to operation lay in the fact that the previous sores upon the lip had healed after curettement, and the patient clung to the idea that radical measures were unnecessary. By the first of January the patient became convinced of the necessity for radical measures, so he entered Christ's Hospital.

On January 4, 1900, the lower lip was split midway between its centre and the right angle of the mouth, and the incision was carried backward in a curve to the lower part of the ear. Everything suspicious, including the submaxillary gland, was removed. Some black, sloughing tissue was found in the vicinity of the sinus in the submaxillary region. This was removed with a sharp spoon. The ulcer in the mouth was removed by carrying an incision completely around it. In the dissection of the neck, the lingual artery was divided.

Within three weeks after the operation an enlargement began just posterior to the hinder limit of the incision in the neck. A sinus remained under the jaw in the submaxillary region.

About this same time œdema of the right side of the face made its appearance, followed a few days later by œdema of the left side. The swollen condition was more marked in the morning and disappeared more or less towards evening. Following this development, there were indications of involvement of the nasal passages, probably in the antra of Highmore. The peculiar œdematous condition was very well marked. A very considerable amount of discharge from both nostrils occurred within a short time.

By the middle of February the patient began to suffer from symptoms of pressure upon the œsophagus. This was associated with a general brawniness of the right side of the neck extending from the mastoid process down to the clavicle. The sinus in the neck, above referred to, was very much increased in size by

sloughing, and four or five irregular, lumpy enlargements made their appearance under the jaw close to the median line. Some of these opened spontaneously. A portion of the lower jaw was denuded and presented in the opening.

In the meantime a curious change was taking place in the lump under the ear,—instead of remaining hard, it began to soften. This softening proceeded so rapidly that by the 21st of February fluctuation was distinct. Incision into the mass evacuated about three ounces of a thin, greenish-yellow fluid containing numerous white or whitish-yellow particles looking like caseous masses. The entire quantity was collected in a sterile bottle. Evacuation of the fluid relieved the pressure symptoms very appreciably.

There could now be no doubt but that a condition other than epithelioma was present, and from the complex of symptoms actinomycosis was the most probable. A prolonged microscopic examination of the evacuated matter led to the discovery of the streptothrix, and later to typical ray fungi.

Having now made a positive diagnosis, the treatment suggested itself. Potassium iodide was given, and the sinuses were daily washed out with a mixture of boric and salicylic acids in glycerine. The initial dose of the iodide was thirty grains four times daily. Five additional grains were added every second day. In order to give the treatment a thorough trial, the patient was again removed to Christ's Hospital.

The treatment seemed to produce a profuse watery discharge from the sinuses, and the appearance of the open wounds improved, but his general condition steadily declined. Swallowing was very painful. Nothing but liquids could be taken.

On the afternoon of March 3, 1900, a severe arterial hæmorrhage took place from the submaxillary region. The house surgeon succeeded in checking this by means of firm packing. The patient did not rally from the exhausting effects of the hæmorrhage. He died at 5.30 A.M., March 4, 1900. A necropsy could not be obtained.

In retrospect, it seems probable that the primary infection took place about the teeth, and that the developments in the lip and cheek were inoculations from the primary focus.

No source of primary infection is clear. The patient had

nothing to do with cattle. He used what is known as a "wax stick" in his business. This is used in the setting of diamonds. While working upon a setting it is customary to hold the end of the "wax stick" in the mouth so as to be able to use both hands in the work. Of course, this may have been the source of infection, but a previous infection of the "wax stick" is by no means easy of explanation.

I have on several occasions noticed the patient walking along the street chewing wisps of hay. It is possible that infection occurred through this medium.

The very excellent and masterly review of this subject by Dr. John Ruhräh, in Vol. xxx of the ANNALS OF SURGERY, renders elaboration on my part entirely unnecessary; in fact, such an attempt would be a work of supererogation.

Case XXII in Dr. Ruhräh's report presents many points of similarity to the one here reported.

The fatal hæmorrhage in this case probably came from the lingual artery which had been divided at the time of operation. Because of our inability to ligate this vessel, a hæmostatic forceps was left on the divided end of the artery for forty-eight hours. The artery was divided January 4, 1900; the fatal hæmorrhage occurred March 3, 1900.

From the later symptoms of this patient, one is warranted in the assumption that the disease had progressed downward towards and probably into the mediastina.

The reporter of this case pleads guilty to remissness in not making more prolonged and persistent microscopic examinations earlier in the case. His only excuse is lack of experience in this class of cases, and that the early course of the disease did not suggest the real condition. So far as the records go, this is the first case of this disease in the human in Cincinnati or vicinity.

TRAUMATIC RUPTURE OF THE SMALL INTESTINE; ABDOMINAL SECTION; RECOVERY.

By JOHN J. BUCHANAN, M.D.,

OF PITTSBURG, PA.,

SURGEON TO MERCY HOSPITAL.

John Zovish, Polander, aged eighteen years, mill laborer, of fair muscular development and of previous good health, was admitted to Mercy Hospital on June 14, 1900, at seven o'clock in the morning, with what had been considered a trifling injury. He was seen by the writer at ten o'clock, and, through an interpreter, stated that at five o'clock the same morning he had received a blow in the abdomen from the handle of a pair of long tongs, with which he had been carrying a billet of iron. He was unable to say just where he had been struck, but pointed in a general way to the neighborhood of the umbilicus. No ecchymosis or sign of contusion was present, nor was there any special area of tenderness to locate the point of impact. His general condition was good and gave no indication of serious injury. His pulse was of good volume, regular, and counted eighty-eight per minute. His temperature was 98° F. He had passed urine in normal amount and without indication of the presence of blood. He had had very little pain, and this was controlled by the application of an ice-bag; no morphine was required. He stated that shortly after he had been struck he had vomited. He also vomited some fluid of a bilious character on a single occasion after his admission to the hospital.

There was no abdominal distention, nor was there any excessive rigidity of the abdominal muscles; at the same time the abdomen had not its normal soft condition. Tenderness was present to a slight extent, chiefly in an area of a few inches about the umbilicus; but this tenderness was not to be compared to that which is present in local peritonitis, say, from appendicitis. It

certainly was not more than is usually present in contusions of the abdominal wall. But here there was no evidence of contusion. *Peristalsis was almost absent.* And on this symptom, taken with the slight rigidity, the moderate pain, and the fact that he had vomited twice, an abdominal section was decided on.

An hour later, under ether anæsthesia, a median incision was made below the umbilicus. There was no evidence of injury to the abdominal wall. As soon as the peritoneal cavity was opened, the serious nature of the accident was confirmed by an outflow of seropurulent fluid, and the thickened and congested condition of the presenting bowel. The incision was rapidly enlarged, and the inflamed intestine was delivered and examined. A rupture of the small intestine was found at the free border, about the diameter of a lead-pencil, with eversion of the mucous membrane and fæcal matter exuding in small amount. This rupture was at once closed by a single continuous suture of fine chromicized catgut. The mucous and submucous coats were first tightly closed with a single line of glover's suture; the muscular coat was next united by a continuation of the same suture in the reverse direction; and, finally, the thread was again reversed, and the same over-and-over stitch used to invert the peritoneum.

A systematic examination of the entire small intestine from the duodenum to the ileocæcal valve was made, during which about a pint of seropus was evacuated. Flakes of inflammatory lymph in large numbers were adherent to the bowel. The rupture was approximately at the junction of the jejunum and ileum. The descending colon was examined, but the ascending and transverse portions could not be delivered for examination. Several gallons of warm surgical salt solution were used to cleanse the bowels and abdominal cavity. The peritonitis was not general, but involved about one-third of the small intestine, and there was no effort at localization. After the intestines had been returned and the cavity dried with pads, a long glass drain was passed to the floor of the pelvis and the incision closed with perforating sutures of silkworm-gut.

The head of the patient's bed was elevated ten inches, according to the suggestion of Dr. George R. Fowler (*Medical Record*, 1900, Vol. lvii, 617), and kept so for four days. The drain was emptied every half-hour during the first night, and at longer intervals afterwards. The tube had almost ceased to drain in two

days, and was then removed. The only unfavorable symptom which the patient exhibited during his convalescence was vomiting, which occurred several times on the second day. Good peristalsis returned within twenty-four hours.

The points of interest in this case are (*a*) the extensive peritonitis and free exudate present within six hours of the injury; (*b*) the rupture of intestine without trace of external injury, and from what would appear to have been a slight blow; (*c*) the almost entire absence of symptoms apart from cessation of peristalsis and slight vomiting, and (*d*) the apparently favorable effect of Fowler's posture in the after treatment. This case is not remarkable in any particular, but is reported to emphasize the importance of early diagnosis and prompt operation in suspected concealed abdominal injuries, and the apparently good effect of Fowler's postural treatment after operation.

A STUDY OF ONE THOUSAND OPERATIONS FOR ACUTE INTESTINAL OBSTRUCTION AND GANGRENOUS HERNIA.[1]

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(CONCLUDED FROM PAGE 514.)

Femoral Hernia.

One hundred and eighty-eight cases; died, 69; mortality, 37 per cent.

Males, 30; died, 10; mortality, 33 per cent.

Females, 154; died, 58; mortality, 38 per cent.

Ratio, males to females, 1 to 5.

Right side, males, 16; females, 85.

Left side, males, 9; females, 47.

It is evident that:

(1) More femoral herniæ are seen in a gangrenous condition than the usual ratio of inguinal hernia.

(2) That the ratio of the usual frequency of distribution of hernia in the two sexes is entirely reversed.

(3) That the ordinary distribution of the two kinds of "groin" herniæ in women, which is approximately as 1 is to 1, is changed to fifteen times as frequent when the femoral herniæ of women become gangrenous.

The chief reasons for the greater liability to accidents of femoral herniæ, the writer believes, are that:

(*a*) Ordinarily (till a mishap supervenes) a femoral hernia, supported or not, gives less trouble than an inguinal, is less under observation, and is therefore given less consideration

[1] Read before the New York Surgical Society, May 9, 1900.

and watchfulness, thereby not so soon calling attention to accidents of strangulation.

(*b*) Accidents of strangulation, owing to the anatomical conditions, are less readily overcome by the patient, and deception as to the accomplishment of relief by taxis even in skilled hands is also more frequent.

(*c*) Strangulation once set up, from the unyielding nature and narrowness of the canal, destructive changes are more certainly and quickly produced.

(*d*) Not infrequently the first appearance of a femoral hernia is coincident with its strangulation.

Umbilical and Ventral Hernia.

Twenty-two umbilical, 2 ventral; died, 16; mortality, 67 per cent.

Males, 3; females, 20.

Resection, 16; died, 10.

Resection and artificial anus, 3; died, 1.

Artificial anus, 2; died, 0.

Various, 3.

This form of hernia is particularly severe in its consequences. The patients are usually of the stout, flabby type, with little resisting force. Even the operation of radical cure of the non-strangulated form of this variety of hernia is attended with a considerable mortality. By many, and the writer thinks wisely, its performance is only indicated in the presence of disabling or increasing symptoms, or failure of mechanical support to give proper relief. The class of patients is therefore a most important factor in the mortality of the operation.

The operation is apt to be attended with great technical difficulties, separation of adhesions, etc., and very large portions of intestine may have to be removed.

One operator [17] had to remove 466 centimetres of small intestine; on post-mortem, what little remained of the small intestine was found to be also gangrenous; in other words, he had not performed a sufficiently radical operation.

One resection of 225 centimetres [17] was also fatal, but

one [18] of 186 centimetres was successful. Two of these operations were in the course of pregnancy, one patient surviving.

Obturator Hernia.

Seven cases; died, 6; mortality, 86 per cent.

Five were treated by laparotomy, of which two were simply reduced, both dying from gangrene of the gut.

Three resections, one cure; three artificial anus, all died.

This form of hernia is apt to be overlooked, and pursues the ordinary course of a supposed intestinal obstruction. The constriction is very marked, and the most drastic remedial measures are usually necessary. In one operation the time is given as three hours,—almost necessarily fatal, *per se*.

TABLE IX.

Results of Three Hundred and Fifty-four Operations for Gangrenous Hernia.

Days of Obstruction.	Resection, with Immediate Reunion of Intestine.			Resection, with Artificial Anus of Ends of Intestine.		Artificial Anus.		Invagination of Gangrenous Portion.		Entero-anastomoses, etc.		Total	Died.	Mortality, per cent.
	No. of Cases.	Deaths.	Mortality, per cent.	No. of Cases.	Deaths.	No. of Cases.	Deaths.	No. of Cases.	Deaths.	No. of Cases.	Deaths.			
1	9	0	0	0	0	0	0	3	0			12	0	0
2	35	3	9	4	4	13	5	4	0	2	1	59	14	24
3	41	10	24	9	2	12	8	4	1	2	2	68	23	34
4	33	9	27	3	1	9	6	2	1			47	17	36
5	23	7	30	6	4	9	5	2	0			40	16	40
6	17	8	47	0	0	6	4	2	1			25	13	52
7	7	2		0	0	2	0	0	0			9	2	. .
8	13	4		2	1	7	3	0	0			24	10	. .
9	2	1		0	0	4	4	0	0			6	5	. .
10	6	3		2	1	1	0	1	0			10	4	. .
11	2	0		1	1	0	0	0	0			3	1	. .
12	1	0		0	0	1	0	0	0			2	0	. .
13	0	0		1	1	0	0	0	0			1	1	. .
14	1	0		0	0	1	1	0	0			2	1	. .
Third week	2	1		1	0	1	1	0	0			4	2	. .
Fourth week	0	0		0	0	1	0	0	0			1	0	. .
Not stated	34	10		1	0	4	1	2	0			41	11	. .
Total	226	58		30	15	71	38	20	3	7	6	354	120	. .
Mortality	26 per cent.			50 per ct.		53 per ct.		14 per ct.		. . . .		34 per cent.		. .

Three unclassified operations to be added: second day, 1; eighth day, 2. All fatal. 2 2 . . 1 2

RESULTS OF TREATMENT OF GANGRENOUS HERNIA.

These figures (Table IX) demonstrate a marked superiority of resection and primary enterorrhaphy over artificial anus, with or without resection of the gangrenous intestine. They are, the writer believes, the first *large* collection of carefully selected cases occurring in *recent* years. It is freely conceded that statistics derived from the literature are much better than the results of actual practice; but it must be borne in mind that these statistics are largely drawn from extensive reports of individual operators and clinics. and that the cases of artificial anus have been tabulated hand in hand with the cases of resection. Moreover, the writer has classed, and he believes properly so, as fatal such cases of artificial anus as made a good recovery, but succumbed to secondary operations for the reunion of the gut.

The factors influencing the better results of treatment of gangrenous hernia over that of intestinal obstruction may be expressed as follows:

(*a*) Limitation of the septic process,—plastic peritonitis obliterating the general cavity. Such an event does not invariably occur; but it is the greatest factor in the result. The surgeon cannot do better than to accept Nature's hint and assistance, and, whenever applicable, seek to convert his intraperitoneal work into extraperitoneal by excluding suspicious gut or doubtful anastomoses from the general cavity by intelligently applied temporary packing.

(*b*) Operative indications are simplified, that is, the surgeon has the diseased conditions plainly in sight, and need waste no time in preliminary procedures.

(*c*) Operative technique is simplified, the operation being done outside of the abdominal cavity.

(*d*) Herniæ come to operation on an average earlier than do cases of obstruction; in this instance, the contrast is not so important, as the question of dosage of absorption in proportion to the duration of obstruction is naturally modified by the protected position of the hernia. A careful computation of these cases shows, however, that at the time of operation, ob-

struction will have existed in hernia, on an average, 101.28 hours; in intestinal obstruction, 115.92 hours, or as 7 is to 8.

That in these modern days a hernia should not come to operation till on the average more than four days have elapsed, shows that there is still much missionary work to be done.

The present array of statistics is much more favorable to results of operations for gangrenous hernia than has ever been published.

Mr. Kendal Frank's [27] series of 227 resections prior to 1893 (beginning with Ramdohr in 1727) makes a most interesting comparison with the present series of 226 since 1887, the mortality of the earlier being 47 per cent.

Zeidler's [15] statistics, published in 1892, are also worthy of comparison.

Resections for gangrenous hernia, 289; died, 142; mortality, 49.13 per cent.

Artificial anus for gangrenous hernia, 287; died, 213; mortality, 74.22 per cent.

It is perfectly fair, the writer believes, to ascribe the improved statistics of primary resection (mortality, 26 per cent.), and its superiority over artificial anus, to improved technique, and especially to the greater familiarity with such particular technique by operators in general.

The value of mechanical aids in making these improved results possible must not be underestimated. Of these the Murphy button, even with its acknowledged drawbacks, is undoubtedly the best, and has so far not yet yielded to any other, although probably no mechanical device ever introduced into surgical practice has produced so great a stimulus towards its improvement or displacement. Many of the early objectors have been entirely won over; and even if other endorsements were lacking, the unreserved approval of it expressed by Czerny, than whom no one living is better qualified to pass judgment in questions of intestinal surgery, would alone suffice to maintain it in its proper position. It is certainly the best means of reuniting the intestine in the hands of an operator lacking a large experience with enterorrhaphy.

Primary enterorrhaphy with the Murphy button for gangrenous hernia was performed sixty-three times with fourteen deaths, a mortality of 22 per cent. Such a favorable showing for so serious a condition has never been approached, the writer believes; and even allowing for "literary" results,—necessarily optimistic,—must be accepted in all seriousness as evidence of a vast improvement in method.

The portion of the intestine resected is nearly always the small intestine, although many operators speak of "intestine." The cæcum was excised four times,—twice as part of the ileo-cæcal coil, and a portion of the transverse colon once.

The following herniæ required resections of a metre or more (centimetres), 466, 310 (cured), 225, 186, 151, 108. Usually the length removed is noted as pretty small; better results would probably be obtained by erring on the side of generosity in all doubtful cases.

The results of resection in the first few days (see Table IX) show most beautifully the necessity of early operations, and the admirable results obtainable by it. Other tables, such as those of intussusception, show the good results obtained by early operations, chiefly by emphasizing the good or bad condition of the gut, according as interference is early or late. In comparing the results of operations for gangrenous hernia by the standard of the duration of the obstruction, we get a more accurate gauge of the constitutional effects on the patient, as we have a standard condition in all cases,—gangrene of the intestine.

Attention, therefore, is particularly called to the absence of mortality on the first day with nine resections; only three deaths out of thirty-five cases on the second day; then a jump to 24 per cent. on the third day, and progressing steadily till the sixth day, with 47 per cent. Other days should not be worked out on account of the dangerous fallacies of small figures.

Resection without enterorrhaphy,—i.e., artificial anus of the ends, 30 cases; 15 deaths; 50 per cent.

This is a very good procedure, which should be more fre-

quently employed; in fact, if there are no great technical counterindications,—and such must be infrequent,—it is hard to understand why it should not be the ideal method of establishing an artificial anus in gangrene of the intestine, thus fulfilling the double purpose of providing for the outlet of intestinal contents, and eliminating the source of septic absorption. It should add but very little to the length or shock of the operation. The operation will probably receive much more consideration in the future.

Artificial anus, 71 cases; 38 deaths; mortality, 53 per cent.

These cases represent a desperate condition, in which anything but the most simple efficient operation is poor judgment. It is good surgery in treating gangrenous hernia, which is, so to speak, situated outside of the body cavity, just as it is poor surgery to do it in gangrene of the intestine remaining within the peritoneal cavity; but, unfortunately, its efficiency in hernia has often been misunderstood, and applied in the abdomen with the most unfortunate results.

Whether the operation should be performed in one or two stages is a question for the individual operator to answer only in a given case. For hernia, there is, on the whole, little to be gained by waiting and much to lose.

The surgeon must bear in mind that when he makes an opening into the intestine, he must face the responsibility of its future closure. Nature occasionally comes to his assistance, but such a fortunate result is exceptional. Minor measures seem usually to be pretty unsuccessful, and efficient major operations, such as a formal liberation and resection of the fistulous intestine, are attended with a considerable mortality, twelve of the fifty-three fatal cases of artificial anus (with or without resection) are the results of such secondary resections, that is, it has a mortality of 27 per cent.! and this item raises the total mortality of artificial anus by 12 per cent.

Invagination.—Twenty cases; 3 died; mortality, 14 per cent.

This method may be taken as expressive of two pro-

cedures: (1) the turning in of a small gangrenous spot or perforation with a suitable form of peritoneal suture; (2) in somewhat more extensive, but still quite limited, areas of gangrene, by actually producing an artificial intussusception, depressing the necrotic area into the lumen of the gut, and fixing it in place by suture, so as to resemble the entry of the intussusception into the sheath.

While the above method may occasionally be applicable in very limited patches, it has a decided element of uncertainty, and really brings to a favorable case greater elements of danger than would be produced by treatment along ordinary lines. Moreover, it has the disadvantage of being a mode of treatment that fails to accord with the pathology; for, in the great majority of cases, the necrotic process is of uneven extent in the planes of the intestinal wall, being *least* on the peritoneal surface, more in the muscular wall, and *most* extensive in the mucous membrane.

If the method is to be applied at all, the loop of bowel should be isolated with packing, and not returned into the general abdominal cavity till the viability of the gut is demonstrated. With this added precaution, its field of usefulness is considerably extended, though it can never compete with more radical and better measures.

Entero-anastomosis.—Four cases, 3 deaths.

The indications for the performance of this operation must be very limited. Of several methods in which it may be applied, its chief sphere of usefulness will be on one of the following conditions:

(*a*) Strangulation of intestine, doubt of its viability. An entero-anastomosis may be made between the sound ends of the involved loop, the latter being isolated for further consideration, and ultimately receiving the treatment appropriate to its condition. Such a course has the advantage of providing for the uninterrupted normal course of the intestinal contents, no matter what the outcome of the condition of the gut.

(*b*) Resection of gangrene, artificial anus of ends. An anastomosis as described above may be added, providing in

the same way for a continued flow of intestinal contents. Such a method would do away with the discomfort and danger (inanition) of an ordinary artificial anus, and facilitate the closure of the opening by some of the simple expedients that have recently been recommended for such cases. Its application, however, must be very infrequent, and its advantages over primary enterorrhaphy are not manifest.

Part III. General Considerations.

Analysis of Three Hundred Resections and Primary Enterorrhaphy.

Intestinal obstruction, 74 cases; died, 55; mortality, 74 per cent. Hernia, 226 cases; died, 58; mortality, 26 per cent. Total, 300 cases; died, 113; mortality, 38 per cent.

Data in regard to the technical details of resection are available in 289 cases.

TABLE X.

	By Suture.	By Mechanical Means.
Perfect result; patient cured	111	59
Perfect result; patient died, but autopsy showed irreproachable condition	22	13
Died; no index to condition	34	13
Patient cured, but fistula requiring further operation	2	...
Patient cured; fistula not requiring further operation	7	1
Patient died; insufficient removal	7	5
Patient died; imperfection in method	10	1
Artificial anus made after resection	2	1
Death from use of faulty apparatus	...	1
	195	94

Operations by suture, 195; died, 75; mortality, 38 per cent.

Operations by mechanical aids, 94; died, 34; mortality, 36 per cent.

Of these mechanical aids, the Murphy button was used in seventy-six cases, viz.:

Intestinal obstruction, 13 cases; died, 9; mortality, 70

per cent. Hernia, 63 cases; died, 14; mortality, 22 per cent. Total, 76 cases; died, 23; mortality, 30 per cent.

The results as seen in Table X do not show very much improvement, from the use of mechanical aids, in general,—Murphy's button, plates, rings, bobbins, etc.,—over ordinary enterorrhaphy. They do, however, show some superiority for one method, the Murphy button. By the use of this device, resection for intestinal obstruction is lowered 4 per cent. to 70 per cent., and hernia by the same figure to 22 per cent. These differences alone are too small to have any importance; statistical variations to have any weight must be much more marked. By figuring up the data of the first two headings in the table, as compared with the total number by either method, one gets a probably well founded impression that, from the stand-point of technical success, that mechanical devices yield more perfect results; that is, we find 68 per cent. of such results with enterorrhaphy and 77 per cent. with mechanical aids.

The writer believes that this apparently narrow margin between the results of the two methods must be further analyzed. He believes, notwithstanding his personal preference for the application of the suture method, whenever good judgment permits its use, that the difference in favor of mechanical means—really the Murphy button—is actually much more marked, and the following are some of his reasons:

(1) Since the introduction of an efficient mechanical device, the Murphy button, the field of enterorrhaphy (by suture) has generally been restricted to the more favorable cases, even in the hands of surgeons of great skill and experience with the suture methods. This statement is believed to be a fair one, when it is remembered how wide-spread is its use. That there have been many opponents to its employment is true; it is also true that the converts to its use now far outnumber its opponents. Some of the early opposition was of a nature to make amusing reading in later days. As an example, the reader is referred to the solemn warning of König,[14] in 1895, in which he belittles the value of the button as a saving of

time, saying that in his own experience he never lost a case of intestinal resection from shock, and regretting that by its use the operation might be attempted by unskilled operators.

(2) In unskilled and inexperienced hands, the use of the Murphy button will yield better results both as to saving of life and the obtaining of complete success without fistulæ.

(3) The use of the Murphy button extends the field of resection. This statement depends to a large extent on the truth of the foregoing. Skilled and unskilled will frequently use it, when, if it did not exist, preference would be given to the establishment of an artificial anus rather than to a time-consuming enterorrhaphy. And therefore this procedure is a step nearer to the ideal of intestinal surgery, in which an artificial anus can never be a part. This latter operation is not only attended with great discomfort to the patient, but brings of itself three dangers, which cannot be disregarded. Danger to life from inanition if made high up in the alimentary canal, likewise danger from the procedures necessary to close it. There is also a considerable danger from wound infection, with or without a directly fatal result.

Death from Insufficient Removal of Gangrenous Bowel, Twelve Cases.—It goes without saying that this is a serious error; it is not a "legitimate" mishap, as it is usually quite preventable. Enormous amounts can be exsected without seriously impairing the sustenance of life. An instance of this fact is a case reported by Rocci and Fantino[13] of successful resection of 310 centimetres of the small intestine, terminating seven centimetres above the ileocæcal valve. The patient's condition was followed with great care, and the report contains much of interest on this subject. It was found that the ingested food was more quickly passed; the stools were more frequent, more watery, and richer in fat and carbonic acid. The patient, however, did well, and gained slightly in weight this result being probably due to over-feeding. In these statistics there were fifteen resections of 100 or more centimetres. Cured, 310, 186, 141, 135, 127, 125; died, 466, 365, 250, 225, 150, 126, 111, 100 (two).[1]

[1] For special literature on this subject, see Kukula.

If the surgeon bears the above facts in mind, he will not hesitate at making a resection with a generous margin of sound tissue. Such a procedure is all the more imperative, for, as has already been said, the surface limitations of the intestinal damage are generally misleading; the muscular coat being more implicated than the peritoneal, and the mucous membrane more than the muscular.

In addition to the question of the vitality of the gut from pathological processes, there arises that of the necrosis of the wound surfaces in the suture line in end-to-end anastomosis, which, although uncommon, does occur. If it were observed only in resections for inflamed or necrotic intestine, the blame might be placed entirely upon the insufficient removal; but it is seen, though less frequently, in exsections for tumor, stenosis, etc., so that it is of itself a real danger, from the lack of anastomoses of the intestinal vessels. To remedy this trouble, it has been proposed to divide the bowel obliquely, forming an angle whose apex is located at the mesentery.

To do away with the danger of necrosis of the suture line, as well as the technical obstacles to getting a perfect approximation in end-to-end anastomosis, especially the closure at the mesenteric border, and when dealing with segments of uneven calibre, many resort to what is variously termed entero-anastomosis or lateral anastomosis; although the former term should perhaps be limited to communications established between different parts of the intestine without exsection of the intervening portion.

These observations on resection contain notes of twelve cases, in which it was clearly established that the amount of gut removed was too small; and doubtless more could have been added if post-mortem records had been available. It seems particularly important to secure a healthy margin in the proximal segment, where the results of insufficient exsection are usually most obvious.

Imperfections of method consisted for the most part in defects of the technique of suture and approximation, these being clearly differentiated from the mishaps due to necrosis of

the suture line or insufficient removal of damaged gut. Another fatality was due to imperfect hæmostasis of the mesentery. These eleven mishaps, alone sufficient to prevent saving of life, could probably be much increased with complete revelation of facts. Occurring in eleven out of 113 resections, they represent, therefore, at least 10 per cent. of the sources of mortality following resection, a fact which should be emphasized, as it is a hint in regard to the possible reduction of mortality by perfection of operative details.

It may be noted that of ten patients who lived and had fistulæ, a spontaneous cure was obtained in eight cases, a point to be considered when estimating the prognosis of that condition.

Taking the three classes of cases attended with mishaps to the restoration of the continuity, insufficient removal of gut, perforation of the suture line from imperfection of suture with fatal results, and the cases of cure complicated by fistulæ, we find thirty-three cases out of the 253 cases of which data are available, making 13 per cent. of resections that are likely to be imperfect and a source of danger. This estimate is entirely too small, because, in the deaths with details unknown, the proportion is probably much higher; but at all events it is sufficiently high to indicate the necessity of providing against the accidents following such perforation.

Various Methods of Resection and Reunion.—The great majority of the resections were performed by end-to-end anastomosis, whether by suture or by the Murphy button.

Of the end-to-end anastomoses performed by other methods may be mentioned, three by Ullmann's turnip, Ball's decalcified ring, Villard's button, all cured.

There were five atypical resections of the invaginated bowel by the methods known variously as Barker's, Rydygier's, and Maunsell's modified method.

It seems rather remarkable that the typical Maunsell method, which is easy, rapid, and certain, is not oftener used in intestinal resection for acute conditions. It competes strongly with the Murphy button in saving of time.

Resection and reunion of intestines by lateral anastomosis:

By suture, eight cases, four died.

By apparatus, seven cases, two with potato plates, both cured; Senn's plates, one (died); rubber rings, three (one died); catgut rings, one (died). Total by lateral anastomosis, fifteen; died, seven.

These operations do not furnish any material for particular comment, as the number of cases does not warrant an attempt to draw serious deductions from them. They were apparently technically successful, no mishaps being noted. Properly and carefully performed by suturing alone, the operation is perhaps freest from remote disadvantages of any.

There is, of course, some possibility of the inevitable contraction of the anastomotic opening reaching an alarming degree; but the danger is seldom extreme, especially as the custom now prevails of anticipating such a diminution by making a sufficiently long opening (up to four inches). Skilled operations sometimes complete an anastomosis quite quickly; it very rarely is performed under fifteen minutes, and usually takes about thirty minutes, and sometimes considerably longer.

Entero-anastomosis without resection, 13 cases.

This operation is one of the most useful in chronic surgery, but has a very limited application in acute obstruction, except as an addition to other measures. Used alone, it is only called for in conditions leaving the intestinal structures undamaged; and if the continuance of the obstruction does not necessarily lead to further changes (such a condition as is presented by an intussusception which is simply irreducible), and the intestine is not, and will not, become damaged. The field of its application is very limited, and it should be resorted to only after an accurate realization of the actual and possible conditions.

It may also be used without a combination of other procedures as a prophylactic measure, when there is a legitimate doubt of the condition of the bowel, uninterrupted passage of the contents through sound tissue being thereby guaranteed;

if done with a mechanical contrivance, it adds little to the time of operation, and little danger beyond what attends the introduction of the foreign body.

Combined with an artificial anus, as in gangrenous hernia, it has the advantages just described. It also does away more or less completely with the discomforts of an artificial anus, and it favors and simplifies the subsequent closure of the opening either by natural processes or by operation.

The operation was performed as follows:

By suture, 10 times; 7 died. By apparatus, 3 times; 2 died. Total, 13; died, 9. Mortality, 70 per cent.

The apparatus was, cartilage plates, catgut rings, and Murphy's button. In one case two anastomoses were made, one with the button and one with suture.

The mortality shows that the operation was usually performed injudiciously and in improper cases.

Suture Material.—The use of silk in all forms of intestinal suture was wide-spread. It has no obvious disadvantages; its presence in the intestinal tissues creates no reaction; it is permanent, and therefore reliable, easily obtained and prepared, and can be kept ready threaded and quickly available for use.

Catgut is noted as having been used in fourteen cases. It must be acknowledged that these cases show no evidence of bad results from it.

The fate of the various mechanical devices: The Murphy button is the only one providing sufficient material for observation. It furnished two fatalities,—one by kinking of the intestine from the weight of the button; in another, by becoming blocked by a chunk of meat. There is no record of any disaster caused by the separation of the button, or by its presence after liberation. Notes on the time of passing of the button are incomplete (forty-five cases); in some instances it was not found at the autopsy, although believed not to have been passed during life.

The average time of passage of the button was twenty days. In four recoveries, the button was not seen. The longest period was 104 days; the shortest, six days.

Most operators seemed to prefer reinforcing the button with Lembert sutures.

Results of Artificial Anus.

For intestinal obstruction, 89 cases; died, 69; mortality, 79 per cent. For hernia, 101 cases; died, 53; mortality, 52 per cent. Total, 190 cases; died, 122; mortality, 64 per cent.

The results obtained are in accordance with the theoretical limitations of the use of artificial anus.

(1) To give exit to internal obstructions.

(2) To give an outlet to the intestinal contents at a point above a site of constriction, provided that thereby all indications of treatment are fulfilled, that is, the site of constriction does not necessarily require interference, no sepsis existing or likely to develop, or, if present, is provided with treatment destined to remove or limit the focus of absorption, *i.e.*, exsection of the intestine, or treating it extraperitoneally as in an external hernia.

For these reasons, the mortality of artificial anus is lowest in obstruction by foreign body, and highest in obstruction by an unyielding constriction, such as a band, and lower in hernia than in intestinal obstruction, because the surface exposed to absorption is less.

The chief reasons for a high mortality in artificial anus are (1) the class of cases. There is frequently no choice other than this operation; the patient is moribund; no general anæsthesia is possible; hit or miss, an artificial anus is made; if it fortunately happens to be above the constriction, the death agony is alleviated, and the friends feel that at all events some effort at relief has been made.

(2) Failure to go above the point of obstruction. This result generally follows on the above, the patient's condition not permitting of a systematic exploration.

(3) Failure to provide for the relief of absorption from gangrenous intestine. In such conditions the relief of the obstruction is only the relief of a symptom, and death from septic

absorption follows just as surely as if the obstruction were unrelieved. This error the writer believes to be the all-important feature in the question of making an artificial anus: it is due partly to an inability to effect the desired purpose, partly to timidity or hesitation on the part of the operator, and in most cases to failure to realize the necessity of making provision for the relief of the condition. This failure the writer also believes to be partly due to lack of discrimination between the conditions presented by internal strangulation with gangrene and gangrenous hernia. In the latter condition the indications for creating an artificial anus being considerably greater.

Artificial anus is the operation of choice when the patient's condition plainly forbids an ideal restoration to the normal, and it entirely relieves the obstruction, no conditions directly threatening life remaining.

An attempt is made below to classify the results of artificial anus; these are somewhat arbitrary, as the writer has frequently had to estimate them for himself, owing to the meagre descriptions of the cases. The results are compared, first, as to the causes of death and, second, as to the after results of artificial anus. (This second group, with the exception of fifteen cases, is made up entirely of hernia cases.)

TABLE XI.

CAUSES OF DEATH AFTER ARTIFICIAL ANUS.

Shock	37
Pre-existing peritonitis	16
Sepsis	6
Failure to go above site of obstruction	16
Exhaustion	8
Failure to resect gangrene	10
Result of subsequent operations	16
Fistula situated too high up for preservation of life	2
Causes independent of obstruction	9
Deficient technique	3

AFTER RESULTS OF ARTIFICIAL ANUS.

(*a*) Resection for artificial anus after intestinal obstruction, 7 cases; died, 3; mortality, 43 per cent. After hernia,

41 cases; died, 11; mortality, 27 per cent. Total, 48 cases; died, 14; mortality, 30 per cent.

(*b*) Entero-anastomosis without resection, 2 cases; 1 died.

(*c*) Successful closure by minor or plastic operations, 13 times.

(*d*) Fistula closed by means of the enterotome, four times, one death.

(*e*) Fistula closed spontaneously, sixteen times.

(*a*) If those statistics should be reproached for showing an over-favorable result for primary resection, the same cannot be said for secondary enterectomy, which, so far as regards hernia, seems to have a mortality practically equivalent to that of the primary operation. It is, however, the writer's belief that this mortality must be taken seriously, and that, if seemingly exaggerated, it is not inordinately so. Every operator of experience knows how extremely difficult is a secondary enterectomy with the intestine buried and fixed in dense adhesions, the tediousness of the operation, and the liability of injuring the intestine.

Furthermore, it must be remembered that a not inconsiderable proportion of such resections is necessarily done soon after the opening is made, on account of the danger to nutrition due to the high situation, and at a time when the patient has not fully regained his strength. Twenty-one of these resections are recorded as having been done in the two weeks following operation, viz., second day, 5 cases; died, 4; third day, 4 cases; died, 2; fifth day, 3 cases; died, 0; seventh day, 2 cases; died, 0; ninth day, 1 case; died, 1; tenth day, 2 cases; died, 2; eleventh day, 1 case; died, 1; thirteenth day, 1 case; died, 1; fourteenth day, 2 cases; died, 1. Mortality, 57 per cent.

TABLE XII.

METHODS USED TO PERFORM SECONDARY RESECTION.

	By Suture.	Died.	By Murphy Button.	Died.	By Other Methods.	Died.
End to end.	27	8	11	3	Paul's bone tube, 1	..
Lateral	2	2	..	..	Senn's plates, ..2	2
					Robson's button, 1	..
	29	10	11	3		
Mortality.	34 per cent.		27 per cent.			

These last figures are rather small, but they correspond pretty well to the results obtained in the large table of resections, a slight advantage being found on the side of the Murphy button.

The operator should bear in mind the consequences of an artificial anus and the difficulty of its repair, and should, when feasible, leave his opening or openings in the condition most favorable to repair. Among other means, he may do a "prophylactic" entero-anastomosis in addition to the artificial anus, or effect an apposition of the cut ends in gun-barrel fashion, making a subsequent anastomosis through the septum thus formed, and more easily close the ends.

(*c*) A cure by plastic operation does occur usually after some form of wedge excision combined with a Heineke-Mikulicz transverse suture. Sometimes simple refreshing and approximation or inversion of the margins suffices. Many, if not most, of the recorded resections were the sequel of failures of such plastics. So long as the intestine remains fixed, it is hard to keep the sutures in place; freeing the gut is almost a necessity.

(*d*) Spontaneous healing occurs usually only after months, seldom less than three; if it does not close within a year, it must be looked upon as incurable.

(*e*) The use of the enterotome can scarcely be discussed in modern times.

TABLE XIII.

ANALYSIS OF THE CAUSES OF DEATH IN ONE THOUSAND OPERATIONS FOR INTESTINAL OBSTRUCTION AND GANGRENOUS HERNIA.[1]

A	1. Shock, so stated definitely	102	
	Shock, most natural presumption	65	
			167
	2. Peritonitis, pre-existing	37	
	Peritonitis, pre-existing or subsequent	27	
			64
	Sepsis		9
	3. Pneumonia, in all probability septic		18
	Operation abandoned or hopelessly incomplete		3
	Death on table		14
	Exhaustion		6
			281
	4. Intestinal toxæmia		1
	5. Intestinal paralysis		8
B	6. Failure to relieve obstruction		48
	7. Returning of bowel, subsequently becoming gangrenous		14
	8. Rupture of bowel, failure to resect sufficiently		12
	9. Defect on technique of resection		11
	Defect on technique of artificial anus		2
	10. Peritonitis from application of enterotome		1
	11. Septic peritonitis directly due to operation		2
	12. Complications due to the use of mechanical aid to resection		2
	13. Repair of artificial anus		15
	14. Leakage from Meckel's diverticulum		2
	15. Inhalation of vomit		4
	16. Recurrence of obstruction		5
			118
C	Various intercurrent conditions:		
	Epileptic seizure during operation		1
	Perforating ulcer of the duodenum		2
	Convulsions		1
	Pleurisy		1
	Diabetic coma		2
	Hæmoptysis		1
	Cardiac disease		1
	Pulmonary œdema		2
	Gangrene of gut at point distant from intervention		1
			12

The data contained in Table XIII have been given in detail in the hope that their critical study might furnish some indication as to the direction we can and ought to seek an improvement of results.

[1] In a few cases, more than one cause of death was tabulated.

In order to obtain a broad view of the situation, the details have been collated under three large groups:

(*A*) Mortality from circumstances inseparable or a common sequel to the pathological condition.

(*B*) Mortality in part dependent on the pathological condition, but to a greater extent on the *modus operandi.*

(*C*) Mortality from intercurrent conditions.

A. What improvement can be expected when the mortality depends on such conditions as shock, pre-existing peritonitis, and pneumonia?

The outlook is certainly unpromising; but even under these conditions the writer believes the future will give better results.

(1) Shock. Of course this term is very blind, and may be used as a disguise for conditions producing shock *per se.* Admitting necessarily that a large proportion of cases die from pure shock, let us consider how we can best combat it. Our chief reliance must be in prophylaxis and by anticipation of it. Prophylaxis, for the most part, will consist in giving the patient the benefit of the doubt and of an early operation. While the responsibility is generally in other hands than the surgeons, it is not invariably so. So long as a surgeon serenely watches a patient with fæcal vomiting for four or five days (as noted several times), or ingenuously writes, "The case now" (after prolonged observation) "being apparently hopeless, it was decided to do a laparotomy," there is certainly the hope of improvement of results, through betterment of professional standards. Improvement in regard to shock can also be obtained, the writer believes, by improved methods of operating by a better set of operators, that must in all probability develop with the march of progress, broader experience, and more thorough teaching of the future student. Shock is largely due to the length of an operation, and by that term the writer means the total length of an operation. This phrase opens up a very broad field, and one which the writer believes is but little appreciated. Everybody realizes its necessity in general, but the carrying out of it has been obscured by the concentration of effort to shorten a particular part of an operation,—*i.e.*,

an intestinal resection. The writer believes, however, that in the case of many operators this shortening of the particular time for a particular step, while of great, is but of secondary importance. As a particular instance, a case of gangrenous femoral hernia, herniotomy, laparotomy, resection, and end-to-end Czerny-Lembert suture: time of resection, fifteen minutes; *total time* of operation, seventy-three minutes. In performing abdominal section, the peritoneum is more quickly invaded by a large rather than by a small incision, and the source of trouble is sooner located and dealt with. Closure of the abdomen, while of great importance, must be done quickly; time must be saved at every step, and the *whole operation* planned and carried out on that basis.

In addition to the exercise of good judgment as to the nature of the operation which will give the best results, with a minimum of delay and shock, much can be done by attention to small details during and after the operation, such as free stimulation, saline enemata, and infusions, and the maintenance of the bodily heat.

(2) Peritonitis and sepsis; also a question of prophylaxis; operating before the vitality of the intestine is impaired. It may also be diminished by a more universal realization of the simple fact that gangrenous bowel left in or returned into the abdominal cavity necessarily produces a fatal result, no matter to what extent the obstruction—only a component indication for operation—is relieved.

What the future holds for us in the way of development of agencies destined to limit or offset septic intoxication, or to increase the resistance of the human tissues to such absorption, cannot be foreseen. The results already obtained by certain "antitoxins" justify efforts in the search of such adjuvants (or correctives) of surgical art.

(3) All sick persons are liable to contract pneumonia, and none more so than the class of persons under consideration. We may therefore resign ourselves to a certain proportion of such deaths. It must be understood, however, that most of the pneumonias are septic; and it is an established fact that, as a

result of a strangulated hernia, a septic pneumonia may be set up without any peritonitis. Diminution of the sources and limitation of the absorption should lower the proportion of pneumonias. A number of these pneumonic processes are inhalation ("schluck pneumonie") pneumonias, the result of vomiting. Lavage of the stomach as a preliminary to operation will be a prophylactic measure. Pneumonia, as the probably direct result of the administration of anæsthetics, cannot always very well be avoided; but we may at all events be careful to limit the time of anæsthesia and the amount used.

(4) Intestinal toxæmia and paralysis. Relief of obstruction does not necessarily relieve or prevent these complications. Prompt evacuation of the bowels, either by incision and irrigation at the time of operation, or by therapeutic stimuli, will somewhat diminish this mortality. The term is, however, usually used as a mask for peritonitis.

(5) For nearly all the elements of this group we find a reasonable hope of some improvement, even if it can never be possible for human methods materially to influence it.

B. The Conditions Pertaining to the Operation.—This is the direction that extends greater possibilities of betterment of results, and its attainment must be sought for with the greatest earnestness.

(6) Failure to relieve obstruction. A certain proportion of such cases must be considered as inevitable, the patient's condition not allowing of proper search. The number, however, can be diminished if the operator never deviates from the principle that the obstruction *must* be relieved. A certain number of bad results of artificial anus made by groping in the dark can be diminished. And still more so when the abdomen is opened freely, if the operator will not desist until he has found not only an obstruction, but all obstructions. He will find it wise to bear in mind the tendency of certain forms of obstruction to act in combination with others or to be multiple (bands).

(7) The returning of bowel, subsequently becoming gangrenous; an entirely preventable cause of death. In sus-

picious cases, the bowel can be treated extraperitoneally (Hahn's method).

(8) Rupture of bowel can be prevented by realizing that resection is necessary, by making a sufficiently generous resection; its consequences may at all events be foreseen and minimized by the extraperitoneal treatment.

(9) Defects in technique of resection and artificial anus (thirteen cases). Improvements in this direction are certainly in order. The operator must make use of such methods as not only give the best results, but also which he individually can perform to the best advantage. Again, in doubtful cases, temporary extraperitoneal treatment is in order.

(10) Peritonitis from the use of the enterotome. It is wisest to forget that such an operation ever existed.

(11 and 12) Avoidable accidents, which, however, are of a class that must be considered to occur in a certain number of cases.

(13) Repair of artificial anus necessarily attended with a certain mortality; a difficult and dangerous operation; improvement may be obtained by prophylaxis, operating on cases before they need such treatment, and doing a primary enterorrhaphy whenever feasible; also by a more thoughtful study of the advantages of the various methods of repair, possibly also by anticipating repair to some extent by the addition of an entero-anastomosis at the time of making an artificial anus.

(14) Leakage from Meckel's diverticulum. The accident can be avoided by the possession of knowledge of the condition and its possible consequences.

(15) Inhalation of vomit; already referred to under pneumonia.

(16) Recurrence of obstruction; prophylaxis by endeavoring to provide against it in the conditions which most frequently give rise to it (intussusception, volvulus).

The above represents a group of 118 cases. It is fair to presume a not inconsiderable proportion of these deaths might have been averted by human means under favoring circumstances. They may be considered as avoidable accidents. A

study of their nature must be instructive, and it is hoped of value.

C. Intercurrent conditions are beyond the control of the surgeon. This group of cases has been calculated in the general mortality, as there were no accurate data on which to estimate the actual or probable result of the operation. Conversely, certain cases dying of intercurrent conditions after a reasonable interval following operation have been put down as cures, because the autopsy (in each case) has demonstrated the absence of directly unfavorable sequelæ to the operation.

A word is perhaps in place here about seven cases of pregnancy.

One gangrenous hernia with volvulus resection; died of sepsis in seventeen days; pregnant, six months; aborted.

One volvulus, resection; died in three days; pregnant, five months; aborted (?).

One hernia, resection, Murphy button, cured; pregnant, seven months; aborted.

One hernia, resection, cured; pregnant, five months; aborted.

One femoral hernia, resection, cured; pregnant (?); aborted.

One umbilical hernia, resection; died first day; pregnant, seven months; aborted (?).

One volvulus, artificial anus; died; pregnant, three months; aborted (?).

Suggestions as to Operation.—Before beginning an operation, every possible contingency should be passed in review, and suitable measures provided for the proper handling of each one. It is especially important that every form of intestinal suture that may possibly be required should be in readiness. Much time is often lost by "bungling" on the part of assistants with the sutures at a critical period of the operation.

If there is vomiting, preliminary lavage of the stomach will diminish the difficulties of anæsthesia and remove a source of danger.

A large incision should be made from the outset, and enlarged so soon as it appears that an intra-abdominal exploration can be more easily and quickly accomplished by it. If the probable cause of obstruction has been previously diagnosticated, the presumptive knowledge of the condition will direct the surgeon's attention to the necessity of investigating certain regions first; in gall-stones, foreign bodies, and Meckel's diverticulum, more particularly the lower ileum; for volvulus the sigmoid, for intussusception the cæcum and colon. Investigation of the cæcum will indicate the general direction of the search; if dilated, there is obstruction of the large intestine; if collapsed, the hinderance is confined to the small intestine. The operator who finds "everything dilated" should at once examine the pelvis for the carcinoma or stricture, which might have been discovered by rectal examination had one been made.

The Advisability of Evisceration for the Purposes of Exploration.—Are the advantages, so far as saving of time, sufficient to counterbalance the disadvantageous elements added to the operation by this step? A great part of the time consumed in operations for intestinal obstruction is spent in locating the lesion; a great many failures to give relief are due to inability to locate the obstruction, and in some cases to find *all* of the offending causes. If one realizes that the cause of obstruction *must* be found, and the quicker the better, and it is not at once evident by an ordinary fair-sized incision, it is far wisest to act radically,—make a sufficient incision, and remove the package of small intestines on the surface of the body. This step determines a condition of shock from a threefold cause,—loss of body heat, circulatory disturbances, and, most important, peritoneal reflexes. The loss of heat may to some extent be offset by assiduous application and renewal of hot moist cloths. The reflexes from peritoneal irritation depend upon the integrity of the peritoneum, increasing with the degree of inflammation present, and the extent of handling of the intestines. There is apparently less shock from lifting up the intestines *en masse* than by pulling on them piecemeal. Tixier [22] found that when

the peritoneum is healthy, the reflexes do not appear for ten to fifteen minutes following evisceration, "period of indifference;" but when inflamed, the reflexes appear at once. This statement appears to correspond with clinical experience, and serves as an indication for the limitations of evisceration. Its chief service is rendered in the search for the obstruction; this object having been attained, and in all probability with celerity, the operative field can be limited, and the bulk of the intestine can be returned. A portion of the abdominal wound may first be sutured for that purpose.

Incision of the Intestine for Evacuation.—While the opening of the intestine for evacuation may be necessary for exploration, it is to be avoided if possible, unless the conditions allow of proper management of this added complication during the rest of the operation. Should it be deemed wise to open the intestine to give relief from further absorption, even after successful removal of the obstruction, and to forestall paralysis, it should preferably be postponed till the close of the operation.

The field of operation having been located, the surgeon's care and resourcefulness in shutting off the rest of the cavity by suitable measures will contribute largely to the prophylaxis of sepsis. If a resection is necessary, it should be performed, so far as feasible, outside of the belly proper; the abdominal cavity being partially closed by sutures or protected by gauze or sponges.

Should it be thought wise to observe a suspicious loop of gut, a resection, or other intestinal condition capable of giving rise to trouble, a suitable portion of the wound may be closed; in the remainder, the loop of intestine in question is exposed, and is completely surrounded (except its anterior aspect) by appropriately disposed gauze packing. Sutures are inserted through all the layers of the abdominal wall, but not tied, unless provisionally to effect some approximation of the walls. Later, say forty-eight hours, under partial or primary anæsthesia, the gauze may be removed, and the bowel returned

and the abdomen closed, entirely or to the extent that seems judicious.

Closure of the abdominal wound. When the patient's condition allows of the expenditure of time, the closure of the abdomen should be a matter of painstaking detail. When time is lacking, it may be quickly accomplished by arming a thread at either end with a long straight needle: the sutures are passed on either side from within outward, and if deftly handled, this method is the quickest, if one of the oldest. A curved needle on a handle (Peaslee, Reverdin) transfixing all the abdominal layers of both sides of the incision is the next quickest method, and one of the best for routine use in securing approximation of the muscular-fascial layer.

The general practice, to-day, usually seeks to obtain early and free movement of the bowels after abdominal section. Its value is especially recognized in checking or preventing inflammatory exudation. McCosh has demonstrated its great value in the presence of severe and extensive peritonitis. His success is undoubtedly due to the radical manner in which catharsis is secured. With an exploring syringe, a saturated solution (two ounces) of magnesium sulphate is thrown directly into the bowel during the operation, the puncture being closed with a stitch. Soon after operation the patient receives calomel by mouth. The writer would most warmly recommend this method in all operations for intestinal obstruction in which it seems wise or urgent to secure immediate catharsis. Naturally, in certain cases, threatening perforation, resections, etc., catharsis will generally be deferred till some days after operation.

Anæsthesia.—The data are meagre and furnish no conclusions as regards the comparative merits of the several forms employed.

Chloroform, 180 cases; died, 73. Ether, 72 cases; died, 32. A. C. E. mixture, 12 cases; died, 2. Chloroform followed by ether, 16 cases; died, 9. Local anæsthesia, 11 cases; died, 3. No anæsthetic, 5 cases; died, 3.

Prognosis of Operations for the Relief of Intestinal Ob-

struction.—The prognosis depends chiefly on the following conditions, in the order of their importance:

(1) The duration of the obstruction.

(2) The extent and severity of the changes in the intestine.

(3) The nature of the obstruction, whether internal or external; for the latter, how unyielding the nature of the constriction and the ease or difficulty with which it can be relieved.

(4) The promptness, good judgment, thoroughness, and skill of the surgeon.

(5) The patient's general condition.

The above points have been pretty thoroughly reviewed in the various portions of this article, and need perhaps no additional comment. Attention, however, is directed to Table IV giving the mortality by days. So long as we are dealing with large figures, the results are very significant and consistent. The percentages cannot be worked out very satisfactorily beyond that point, because, in dealing with a few cases, the fluctuations are necessarily vague and worthless. Tables VII and IX may be studied with particular advantages, as they represent single groups of conditions (intussusception, hernia) with a large number of cases. It is particularly significant that on the first day eleven resections for gangrenous hernia could be performed with a mortality of zero.

It is perhaps unusual to introduce the personal element of the surgeon as a factor in the prognosis. The careful detailed study of this extensive material has, however, impressed the writer that it is an element that deserves special recognition. The possession of "good surgical judgment" is very essential; mere manual dexterity is useless unless based on this quality, which latter depends much on the personal characteristics of the individual.

Summary.

Intestinal Obstruction.—The most frequent causes of intestinal obstruction are intussusception and bands.

The mortality is 47 per cent.

The mortality of resection is 74 per cent.

The mortality of artificial anus is 77 per cent.

The mortality depends on the duration of the obstruction and on its nature being least in foreign bodies, inflicting little or no damage to the intestine (25 per cent.), and most in such conditions as produce a tight constriction as "openings" (67 per cent.).

Hernia.—The mortality is 34 per cent.

The mortality in males is as one is to two.

The proportion of femoral herniæ is 59 per cent.

The ratio of mortality of inguinal herniæ to femoral is as three is to four.

The mortality of resection and primary enterorrhaphy is 26 per cent.

The mortality of artificial anus is 53 per cent.

In General.—Resection and primary reunion by suture, mortality, 38 per cent.

Resection and primary reunion by apparatus (including Murphy button), mortality, 36 per cent.

Resection and primary reunion by Murphy button, mortality, 30 per cent.

A large proportion of deaths is due to failure of technique, such as removal of too little intestine, or imperfect suture. At least 13 per cent. of resections are attended with defects of technique either resulting fatally or in the formation of intestinal fistulæ.

Artificial Anus.—The mortality is lowest in internal obstruction, such as a foreign body, and highest in obstruction by an unyielding constriction, such as a band, and lower in hernia than in internal obstruction, chiefly because the surface exposed to absorption is less. The chief sources of mortality are:

The desperate character of the majority of the cases.

Failure to establish the opening *above* the site of constriction.

Failure to provide for the relief of absorption of gangrenous changes in the intestine; death often necessarily oc-

curring on this account, although the obstruction is perfectly overcome.

Prominent among the drawbacks of artificial anus is the fact that it must subsequently be repaired. For in most cases there is no tendency to spontaneous closure, while minor plastic operations are rarely efficient. Formal liberation of the intestine and secondary resection is usually an exceedingly difficult operation, as is evident by its mortality,—

After intestinal obstruction, 43 per cent.; after gangrenous hernia, 27 per cent. Average, 30 per cent.

The causes of death after operation fall into three main groups:

(1) From causes inherent to the condition and little amenable to treatment,—such as shock and pre-existing peritonitis,—these causes accounting for the majority of fatalities. Improvement can only be hoped for by earlier recognition of the condition, thereby securing the performance of operative relief before the severer changes take place.

(2) From causes depending chiefly on the nature and details of the operation, such as failure to relieve obstruction and defects in technique, or failure to take account of the conditions to be dealt with.

(3) On intercurrent conditions.

Prognosis.—The most essential feature in the prognosis is the duration of the obstruction. In early interference there is generally only one condition to be fulfilled, removal of the obstruction. With long continuance of this condition, secondary changes of the greatest gravity supervene, requiring for their relief measures of great extent and difficulty.

The nature of the obstruction is the next most important factor, acting in the same way as in the first instance as to changes in the intestinal walls, the prognosis being best in internal obstruction, and worst in tight external constrictions.

BIBLIOGRAPHY.

[1] American Journal of the Medical Sciences, May, 1897.
[2] ANNALS OF SURGERY, Vol. xxvi, p. 353.
[3] ANNALS OF SURGERY, Vol. xxix.

[4] Archiv für klin. Chirurgie, Vol. xxxix, p. 173.
[5] Archiv für klin. Chirurgie, Vol. xl, p. 84.
[6] Archiv für klin. Chirurgie, Vol. xlviii.
[7] Archiv für klin. Chirurgie, Vol. liv, Heft 2.
[8] Archiv für klin. Chirurgie, Vol. lx, Heft 4.
[9] Berger: "Dix milles observations de hernies."
[10] Von Bergmann: St. Petersb. med. Wochenschrift, 1896, No. 44.
[11] British Medical Journal, 1896, Vol. i, p. 113.
[12] Brooklyn Medical Journal, 1897, p. 491.
[13] Centralblatt für Chirurgie, 1896, p. 614.
[14] Centralblatt für Chirurgie, 1895, p. 85.
[15] Centralblatt für Chirurgie, 1893, p. 62.
[16] Cf. article by the writer in Archives of Pædiatrics, February, 1900.
[17] Hahn: Deut. med. Wochenschrift, 1897, Nos. 41-43.
[18] Hinterstoissier: Wien. klin. Wochenschrift, 1895, p. 98.
[19] Hofmokol: Klinisch. Zeit. und Streitfragen, Band vi, Hefte 5 und 6.
[20] Journal de Médecine de Bordeau, 1892, p. 39.
[21] Lancet, 1891, Vol. i, p. 1312.
[22] "La pratique de l'evisceration en chirurgie abdominale," pp. 333, Paris, 1898.
[23] Lyon Medical, 1898, p. 215.
[24] Maydl: "Die Lehre von den Unterleibsbrüche," 1898.
[25] Maylaid: Glasgow Medical Journal, 1896, p. 143.
[26] Medical Record, July 17, 1897: "Mortality and Treatment of Acute Intussusception," by C. L. Gibson. This paper contained 239 laparotomies for acute intussusception, but only the cases operated on since 1887 (149 in number) were used as a basis of results of treatment. This series here recorded comprises thirty-eight additional cases published since 1897.
[27] Medico-Chirurgical Transactions, 1892-93, p. 197.
[28] Mittheil. aus der Grenzgebiet der Medicin und Chirurgie, Band ii, Hefte 2 und 3.
[29] Murphy: Deut. Zeitschrift für Chirurgie, Vol. xlv, p. 54.
[30] Schwarz et Rocard: Rev. de Chirurgie, 1892.
[31] Transactions of the London Clinical Society, Vol. xxvii, p. 205.
[32] Treves: "Intestinal Obstruction," 1899.
[33] Winiwarter: "Billroth Festschrift."

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 23, 1900.

The President, B. FARQUHAR CURTIS, in the Chair.

TRAUMATIC CYST OF THE PANCREAS.

DR. ARTHUR L. FISK presented a man, thirty-five years old, who, in December, 1897, received a blow in the abdomen which rendered him unconscious. He recovered from the effects of the accident in a short time, and apparently suffered no ill effects from it until last August, when he was compelled to give up his work on account of frequent attacks of colicky pain in the epigastric region. Examination revealed the presence of a tumor in the abdomen. Upon incision, this proved to be a cyst lying between the liver and stomach. A trocar was introduced into it and six pints of fluid withdrawn. It was found that this fluid digested starch. A drainage-tube was inserted and allowed to remain for two months. The wound closed by granulation. The man suffered for a time from fatty diarrhœa, which was checked by the use of pancreatin. His further recovery was uninterrupted.

MULTIPLE FRACTURE OF PATELLA; SUTURE OF PREPATELLAR TISSUES ONLY.

DR. JOHN F. ERDMANN presented a man, twenty-two years old, who, on March 13, 1900, fell from a wagon. He is unable to say whether he struck his knee or not. He was taken to Gouverneur Hospital with a diagnosis of a transverse fracture of his right patella, with a large amount of effusion of blood, and a separation of an inch between the fragments. Cold applications and rest were employed for ten days, when ether was administered and a longitudinal incision made. Upon exposing the bone, it

was found that the patella had suffered a multiple fracture; apparently, it had sustained a direct transverse fracture, and the distal and proximal fragments were again fractured, each into three pieces, divided very much as one would cut a pie. The dense prepatellar fascia and capsule were united by catgut, both longitudinally and transversely, so as to bring about perfect apposition of the fragments. A subcutaneous drain was inserted, and the superficial structures were united with catgut. The drain was removed in forty-eight hours, when plaster-of-Paris was applied. This was removed on April 24, just four weeks after the operation, and replaced by a posterior splint; this was left on until May 8, when the patient was discharged. The patient is now able to flex his leg about one-quarter of the normal range.

No attempt has been made to forcibly break up the ankylosis, but this is being gradually accomplished by the exercise which the patient takes.

INTESTINAL STRANGULATION BY MECKEL'S DIVERTICULUM, COMPLICATED WITH APPENDICITIS.

DR. ERDMANN presented a man, twenty years of age, who was seen by him with Dr. S. Leo on March 10, 1900, at which time the following history was obtained. On the last day of February, about two o'clock in the afternoon, and about an hour and a half after having partaken of a lunch which consisted of a roast-beef sandwich, cake, and coffee, he was seized with pain in the abdomen, not localized to any one region. He "broke out in a perspiration," and had two or three chills which lasted in all about two hours. He vomited about four hours after the onset of his pain. During this period his pain constantly increased. It remained severe, but was not intensified throughout the night. To control the pain, he was given some codeia by Dr. Leo. He was also given an enema, which brought away a small quantity of fæces.

When Dr. Erdmann first saw the patient, at eight P.M. on March 1, his pulse ranged from 86 to 90; his temperature, which had been 101.5° F. in the forenoon, had dropped to 100.5°. Deep pressure elicited some pain in the abdomen, localized to the right side, a little internal and superior to the usual appendicular situation. The rectus muscle was somewhat rigid. The urine con-

tained no albumen: its quantity had not been measured, but the patient said he had been passing it as frequently and in as large quantities as usual. The codeia was discontinued, calomel was given internally, and ice applied externally.

On the following day, March 2, his temperature was 99.5° F.; pulse, 84. The pain was not excessive, and was localized to the right side. The rectus was still somewhat rigid and there was moderate tympanites, not general, but rather showed distended coils of intestine. On the following day, March 3, there was a slight amount of pain upon deep pressure, but the patient's condition was otherwise apparently normal. Dr. Erdmann was dismissed. On the following evening, March 4, his condition again became aggravated; it was stated that he had twice vomited fæcal material, and that there had been a large evacution per rectum following the introduction of an enema. On Monday morning, March 5, when Dr. Erdmann again saw him, the face was drawn and anxious; pulse, 118; temperature, 101.5°; abdomen generally tympanitic; pain on the right side and some in the umbilical and hypogastric regions. An operation was advised and accepted. Dr. C. Leale was present at the request of the family The usual incision for appendicitis was made. Upon incising the peritoneum a large quantity of dark brown fluid was evacuated, and a coil of deeply congested intestine came into view. The appendix was found bound down posterior to the cæcum and ascending colon, and several coproliths could be palpated. Many recent adhesions were also present. The examining finger palpated a dense band surrounding a mass of intestines. The incision was rapidly enlarged through the right rectus, and then a mass of intestines, fully five feet long, dark brown and œdematous, was extruded, with a Meckel's diverticulum about three inches long and half an inch in diameter at its base, with a long fibrous extension leading up to the umbilicus; this was literally tied about the diseased intestine. One portion of the diverticulum was gangrenous and adherent to a coil of ileum. A small amount of pus was present in this region. The intestinal end of the diverticulum was cut off and its site inverted as in an appendix operation. The umbilical end of the diverticulum was cut after applying a catgut ligature near the umbilicus. The appendix was next removed in the usual manner, the stump being inverted after the method of Dawbarn. A gauze drainage was inserted at the

site of the inverted stump of the appendix, and a second at the site of the removed diverticulum. The greater portion of the wound was then closed with three rows of catgut sutures and a superficial one of silk.

A great amount of serous discharge was present during the first twenty-four hours after the operation. The temperature and pulse practically became normal after the second day, and from that time on convalescence was rapid and uninterrupted.

Dr. Erdmann said that this was the third case of strangulation of the gut by Meckel's diverticulum upon which he had operated since last fall. Two of them were complicated with appendicitis. Two of the patients recovered; one died.

Dr. Charles L. Gibson asked Dr. Erdmann whether in any of his cases of strangulation by Meckel's diverticulum he had noticed the presence of congenital deformities, such as club-foot, cleft palate, harelip, or webbed fingers? It has been suggested that congenital deformities are apt to be present in such cases, and their existence give a clue to the nature of the obstruction.

Dr. Gibson said that, in reviewing the statistics of strangulation of the bowels, he had found that the mortality from strangulation by Meckel's diverticulum was considerably higher than that from other forms of strangulation. This was due to the fact that the operators failed to recognize the true nature of the obstruction in those cases where it was caused by Meckel's band. The diverticulum was not infrequently divided without being secured by ligature, leakage of intestinal contents yielding a fatal result.

Dr. Erdmann replied that he had not observed any congenital deformities in any of his cases where he had been called upon to operate for strangulation of the intestine by Meckel's diverticulum. He had seen seven cases in all.

Dr. A. B. Johnson said he had seen only two cases of intestinal obstruction by Meckel's diverticulum. In one of them the operation was followed by intestinal paresis and death. In the other case the diverticulum was at least five inches long and its calibre as large as a man's thumb. No congenital deformities were noted in either of these cases.

THE RADICAL CURE OF INGUINAL HERNIA IN THE FEMALE; REPORT OF ONE HUNDRED AND TWENTY CASES.

DR. WILLIAM B. COLEY read a paper with the above title, for which see the December number.

SARCOMA OF THE TESTIS.

DR. WILLIAM B. COLEY presented a sarcomatous tumor of the testis, with the following history: A man, twenty-eight years old, had an attack of gonorrhœa nine years ago, and subsequent to this a lump remained in the epididymis for some time, finally disappearing under treatment. Early in January, 1900, he fell astride a beam, injuring his right testis. There was immediate swelling of the testis, and after a week or two it increased in size still further. At the same time he began to feel a slight dragging pain. He visited the Bellevue Out-Patient Department late in January, and was tapped for supposed hydrocele. Nothing but blood was found. Subsequently he was tapped a second time with the same result. On February 8 he consulted Dr. Coley at the Hospital for Ruptured and Crippled, and examination at that time showed a tumor of the right scrotum the size of an orange. It was semifluctuating and symmetrical in outline. The skin over it was freely movable, and there was little or no tenderness on pressure. The diagnosis of hæmatocele, with the possibility of sarcoma, was made, and immediate operation advised. Two days later, at the General Memorial Hospital, the tunica vaginalis was opened and about four ounces of dark, grumous blood escaped from the tunica vaginalis. The testis was found enlarged to about three times its normal size, and so soft that it almost fluctuated. Dr. Coley said he regarded it as malignant, and continued his incision up into the inguinal region, removing the entire testis and the cord very high up. The specimen was carefully examined by the pathologist of the hospital, and at first pronounced non-malignant; further and more careful examination of numerous specimens showed it to be a round-celled sarcoma. At the time of the operation there was no evidence of trouble in the abdomen.

The subsequent history of this case, Dr. Coley said, was most interesting. Within two weeks after leaving the hospital the

patient was admitted to Bellevue on account of a large abdominal tumor. Dr. B. F. Curtis made an exploratory incision on March 16, which was less than five weeks from the date of the primary operation, and found a tumor of the right kidney the size of a man's head, of soft consistence, surrounded by a thin capsule, closely adherent to the large intestines and stomach, and having apparently developed between the layers of the mesentery. There was almost no glandular involvement. A portion of the tumor was removed for examination and pronounced a round-celled sarcoma. The patient died on the 18th of April of progressive cachexia and persistent vomiting, due to pressure on the duodenum. The speaker said the case was most remarkable in that the whole course of the disease, from the date of the injury on January 10 to the date of death, April 18, was scarcely more than three months. The case is another example of acute traumatic malignancy, the causal relation between the injury and the development of the sarcoma being beyond question.

Dr. Coley said that, of twelve cases of sarcoma of the testis that he had observed, there was a definite history of antecedent trauma in over 50 per cent. He had never known of a patient having been permanently cured.

Dr. Curtis said it was interesting, in the case reported by Dr. Coley, to note the direct extension of the disease from the left testis to the corresponding kidney. No other organ in the body appeared to be involved and the retroperitoneal glands were not much enlarged. The tumor of the kidney was much larger than a man's head; it occupied fully two-thirds of the abdomen.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, February, 1900.

ECHINOCOCCUS CYST OF THE LIVER.

DR. HIRAM R. LOUX reported a case of resection of the liver for echinococcus cyst as follows:

The patient was a German, aged thirty-one years, who two years ago, after some undue exercise, first experienced pain in right hypochondriac region, and soon thereafter discovered a hard mass in that region. He paid little or no attention to this until two months prior to his operation. When Dr. Loux was consulted in reference to this tumor, on examination, a hard, firm, somewhat nodular mass was felt in the right side just below the costal arch. By palpation the mass was freely movable. It had never occasioned any pain or discomfort except at the time when he first discovered the tumor. He has suffered somewhat, however, from indigestion. For some years past, his general health, as he states, has been below par, which he has attributed to the condition of his stomach.

An exploratory operation was advised, to which the patient consented, and on May 10, 1899, an incision was made over the most prominent portion of the tumor corresponding to the linea semilunaris. As soon as the abdomen was opened, it became clear that the tumor was hepatic. Its attachment was by a broad pedicle to the lower border of the left lobe of the liver. The tumor was somewhat firmly adherent to the adjacent tissues. After breaking up the adhesions and delivering the tumor through the abdominal wound, a resection of that portion of the liver structure to which the pedicle was attached was accomplished by the use of the Paquelin cautery. The peritoneal cavity was shut off by iodoform gauze, which was packed through the incision prior to the extirpation of the tumor. By burning through the liver

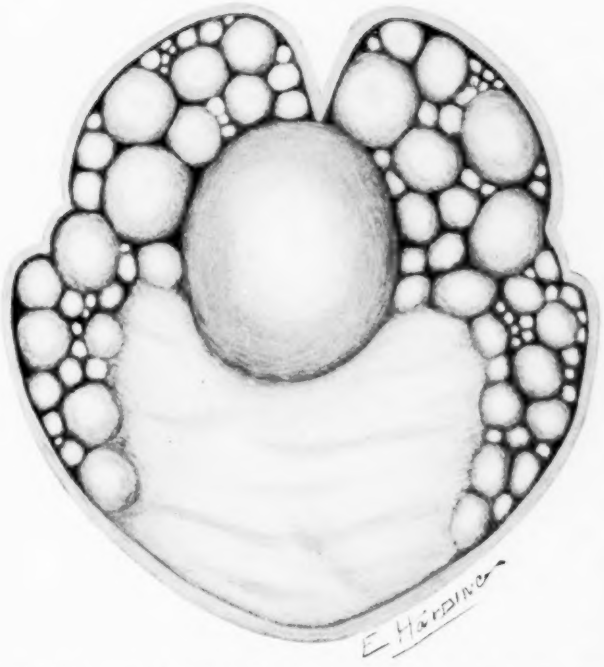


FIG. 1.—Hydatid cyst showing daughter cysts. In the lower part of the figure is a whitish mass containing parts of the wall of ruptured daughter cysts. The thick wall of the mother cyst is well shown. (Removed by Dr. H. R. Loux from liver of a man. The illustration is two-thirds the natural size. Weight, 197 grammes. The patient recovered.)

substance with the cautery heated to a dull red, about an inch and a half from the attachment of the pedicle of the tumor, there was no difficulty in controlling the bleeding. At points where the hæmorrhage was not arrested by the passage of the cautery, repeated applications of the point seared the surface superficially and arrested all bleeding.

The tumor was pear-shaped, eight centimetres in its longest diameter, five centimetres in its transverse diameter. Its weight 197 grammes.

The recovery was uninterrupted. The highest temperature was on the second day, when it reached $101^{2}/_{5}^{\circ}$ F. On the third day after the operation there was rather a free discharge of bile through the abdominal wound, which continued about fifteen days, and gradually ceased. The wound completely granulated and closed at the end of three weeks.

The pathological report showed that had the cyst been detached from the pedicle, and a portion of the liver not removed, there would have been a strong probability of recurrence, for the microscopical examination revealed the fact that the interior of the cyst wall contained a large number of brood-capsules filled with scolices and connected with the parenchymatous layer, a condition which would predispose to recurrence had the pedicle not been removed.

The pathological report by Professor Coplin is as follows:

Specimen.—Tumor removed from within peritoneum adherent to the liver.

Specimen consists of a pear-shaped mass of tissue eight centimetres in its longest diameter, five centimetres in its transverse diameter. Weight, 197 grammes. Its external surface is rough, apparently as a result of having been detached from the adjacent tissue. Two centimetres from the smaller end there is slight constriction, which would appear to divide the specimen into two masses. On section, however, this constriction is seen to be present only on the surface. On longitudinal section, the knife first cuts through a very dense capsule two centimetres in thickness. This capsule is remarkably uniform in thickness and texture. Immediately within the capsule we come in contact with a large number of cysts apparently free within a cavity, that is unattached, but surrounded by a homogeneous matrix which closely resembles at the periphery the coagulated white of an egg. As we approach

the centre of the growth it changes from a cloudy-white opacity to a gelatinoid material quite as clear as ordinary gelatin used for culture purposes. Running through this gelatinoid tissue are bands one to two millimetres in diameter which are slightly more opaque than the surrounding matrix, and resemble in color threads of dried agar-agar. In consistency the material is soft;

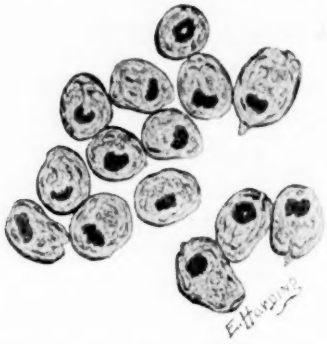


FIG. 2.—Echinococcus. A group of scolices. (From Dr. Loux's case.)

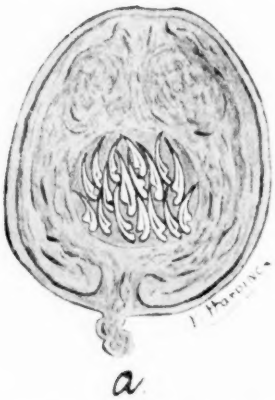


FIG. 3.—Echinococcus. Scolex; *a*, pedicle of attachment to endocyst. Just above are shown the somewhat disarranged hooklets. (From Dr. Loux's case.)

it cannot be picked up by the fingers, as, when this is attempted, it falls to pieces. Embedded within this are the cysts above mentioned. By gently pulling apart this gelatinoid material we are able to count sixteen of these small cysts. The smallest is not over two millimetres in diameter, the largest an egg-shaped mass

three and one-half centimetres in its longest diameter, two centimetres in its transverse diameter. These cysts are perfectly transparent, and when opened are found to contain a clear, watery fluid, faintly alkaline in reaction, specific gravity, 1.007, and containing a trace of albumen and sugar. The walls of the cysts are very thin, and no macroscopic measurement is possible. A few of the cysts have been opened and the contents examined microscopically. There were found a few large endothelioid cells, few leucocytes, and cholesterin crystals. The wall was examined without finding anything characteristic, but examination of a smaller cyst demonstrated the abundant presence of innumerable echinococcus hooklets.

A further examination of scrapings from the interior of a cyst wall demonstrated very beautifully the brood-capsules filled with scolices and connected to the parenchymatous layer, the picture constituting an almost prefect reproduction of the left hand capsule, Fig. 437, p. 558, Ziegler's "General Pathology," 1895, ed. English translation.

Dr. Loux also presented abstracts of twenty cases of operations for hydatid cysts of the liver, compiled by Max. R. Dinkelspiel.

CASE No. 1.—*Reference,* O'Conor, *Glasgow Medical Journal,* Vol. xlvii, p. 347. Female, aged fifty-one years. *Nature, size, and duration,* hydatid cyst. *Method of removal,* hepatotomy, three-inches incision, slightly external to right, semilunar line. Trocar inserted. Blunt-pointed bistoury passed alongside of trocar and one-half-inch incision made into liver substance. *Result,* death on day following operation. *Remarks.* Enormous hæmorrhage arrested by sponge pressure.

CASE No. 2.—*Reference,* Morgan, *London Lancet,* 1895, Vol. i, p. 344. Female, aged thirty-eight years. *Nature, size, and duration,* hydatid cyst; four years. *Method of removal,* vertical incision over tumor in right linea semilunaris; cyst wall dissected away with forceps. Bleeding stopped by ligatures and hot sponges. *Treatment of stump,* intraperitoneal. *Result,* recovery in three weeks. *Remarks.* Enough small cysts to fill a pint bowl; cysts varying in size from that of a pin's head to a cherry.

CASE No. 3.—*Reference,* Loretta, *Mem. della R. accademia dell' Scienze dell' Instituto di Bologna,* 1886-1888, quarta tomo

viii, p. 581, in *Boston Medical and Surgical Journal*, April 28, 1892. Male, aged forty years. *Nature, size, and duration*, two years; echinococcus cyst; size of fœtal head. *Method of removal*, bistoury. *Treatment of stump*, edges of capsules of Glisson stitched together and also to abdominal wall. Collodion and iodoform dressing. *Result*, recovery. *Remarks.* Diagnosis, suspected echinococcus.

CASE No. 4.—*Reference*, Brazil, *London Lancet*, March, 1897, Vol. i, 624. Female, aged thirty-two years. *Nature, size, and duration*, hydatid cyst; duration about one and three-quarters years. *Method of removal*, first operation, October 4, 1886; no cyst found. October 13, 1886, incision three inches long over eighth rib in mid-axillary line; one inch of rib resected, leaving periosteum, and cyst wall removed. *Result*, recovery. *Remarks.* Two ounces of fluid evacuated.

CASE No. 5.—*Reference*, Bobroff, Khirurgia Mosk., in *Centralblatt für Chirurgie*, 1897, p. 1115. Female, aged twenty-five years. *Nature, size, and duration*, echinococcus alveolaris; four months' duration; fourteen centimetres in diameter, weight 200 grammes. *Method of removal*, excision; floor of excision still of tumor substance. Iodoform gauze tampons. *Treatment of stump*, extraperitoneal. *Result*, recovery in forty days. Recurrence. *Remarks.* Two previous childbirths followed by apparent right inguinal adenitis.

CASE No. 6.—*Reference*, Bruns, *Revue de Chirurgie*, No. 12, 1896, p. 976; *Beiträge klin. Chirurgie*, 1888; *Pennsylvania Medical Journal*, October, 1897. Female, aged forty-four years. *Nature, size, and duration*, echinococcus cyst in lobus quadratus. Size, child's head. Duration, seven months. *Method of removal*, cautery. Ligation of pedicle. *Treatment of stump*, disinfected with $HgCl_2$ and return to abdominal cavity. *Result*, recovery in nineteen days. *Remarks.* Diagnosis, tumor of mesentery or omentum.

CASE No. 7.—*Reference*, Garre, *Beiträge klin. Chirurgie*, 1888, Band iv, p. 181. Female, aged forty-four years. *Nature, size, and duration*, echinococcus cyst. *Method of removal*, thermo-cautery. *Treatment of stump*, returned to abdominal cavity. *Result*, recovery. *Remarks.* Tympanites.

CASE No. 8.—*Reference*, Landouzy and Segond, *Bulletin de la Société de Chirurgie de Paris*, 1887, No. 13, see *Pennsylvania*

Medical Journal, October, 1897. Male, aged fifteen years. *Nature, size, and duration*, echinoccoccus cyst. Duration, three months. *Method of removal*, abdominal section. Aspiration. Removal of cyst wall and liver tissue covering cyst. *Treatment of stump*, liver attached to abdominal wall by two silver sutures. Drainage. *Result*, recovery.

CASE NO. 9.—*Reference*, Depage, *Gaz. hebd. de Méd. et de Chirurgie*, March 13, 1898, from ANNALS OF SURGERY, September 13, 1899. Female, aged twenty-two years. *Nature, size, and duration*, hydatid cyst in quadrate lobe, three others in left lobe, all size of the fist and of five years' duration. *Method of removal*, incision across rectus abdominis. Resection of part of left lobe with Paquelin cautery. Cyst in quadrate lobe enucleated; packing and drainage-tube. *Treatment of stump*, intraperitoneal. *Result*, recovery in fifteen days. *Remarks.* At first infection with Bacillus coli communis. Small fistula, which closed later.

CASE NO. 10.—*Reference*, S. White, *British Medical Journal*, 1897, Vol. ii, p. 398, from ANNALS OF SURGERY, September, 1899. Male, aged seventeen years. *Nature, size, and duration*, "some time." Hydatid cyst under surface of left lobe. Size of a cocoanut. *Method of removal*, adhesion separated, cyst excised at base. Closure with six deep silk sutures. Hæmorrhage stopped by pressure. *Treatment of stump*, returned to peritoneal cavity. *Result*, recovery in short time. *Remarks.* Cyst dark red and looked like a malignant tumor during operation.

CASE NO. 11.—*Reference*, Ruggi, *British Medical Journal*, April, 1892, p. 408. Female, aged twenty-two years. *Nature, size, and duration*, double echinococcus cyst; two years' duration; oblique diameter about nineteen centimetres. *Method of removal*, eighteen by ten inches of liver excised; vessels tied with catgut. *Treatment of stump*, edges of cavity sutured to the peritoneal edges of the abdominal wound. External treatment. *Result*, recovery. *Remarks.* Diagnosis, echinococcus of kidney.

CASE NO. 12.—*Reference*, Palleroni, *Centralblatt für Chirurgie*, 1898, p. 1110; *Gaz. hebd. de Méd. et de Chir.*, 1898, p. 805. Female, aged fifty-five years. *Nature, size, and duration*, echinococcus cyst; size of hen's egg; adherent to gall-bladder. Noticed about one year. *Method of removal*, cyst dissected out and hæmorrhage arrested by tampons. Liver held to abdominal wall by silk thread. *Treatment of stump*, intraperitoneal. No drain-

age. *Result,* recovery. *Remarks.* Walls of cyst partially calcified.

CASE No. 13.—*Reference,* Igmio Tansini, *British Medical Journal,* 1891, Vol. i, p. 81. Female. *Nature, size, and duration,* hydatid cyst. *Method of removal,* total extirpation; excision of a portion of the liver. *Treatment of stump,* wound closed with sixteen sutures, some being catgut, others silk. *Result,* recovery within fourteen days. *Remarks.* No post-operative complications.

CASE No. 14.—*Reference,* Boggi, *Wiener med. Presse,* No. 21, 1889. Abstracted from "Progress of Medical Sciences," September, 1889, p. 300. Female. *Nature, size, and duration,* double echinococcus cyst weighing three pounds. *Method of removal,* enucleated. Resection of three inches of liver parenchyma. *Treatment of stump,* edges of liver cavity secured in abdominal wound. *Result,* recovery. *Remarks.* Free discharge of bile through the wound.

CASE No. 15.—*Reference,* Jones, *London Lancet,* 1894, Vol. i, p. 860. Female, aged twenty-one years. *Nature, size, and duration,* hydatid cyst six months, contained 124 ounces of fluid. *Method of removal,* incision middle line three inches long, one and one-half inches below ensiform cartilage; cyst incised and portion of cyst wall removed; drainage. *Treatment of stump,* cyst wall stitched to abdominal incision. *Result,* recovery four months. *Remarks.* Small pieces of cyst's wall came out of abdominal incision for four months.

CASE No. 16.—*Reference,* Vohtz, *Hospitals Tidende,* 1889, pp. 610-615. In ANNALS OF SURGERY, 1890, Vol. xi, p. 288. Female, aged twenty-one years. *Nature, size, and duration,* echinococcus cyst; size of child's head; duration "some time." *Method of removal,* excised with a portion of greatly atrophied liver tissue. *Treatment of stump,* intraperitoneal. *Result,* recovery.

CASE No. 17.—*Reference,* O'Conor, *Glasgow Medical Journal,* Vol. xlvii, p. 343. Male, aged ten years. *Nature, size, and duration,* large hydatid cyst. *Method of removal,* three-inches incision right semilunar line; trocar inserted and cyst evacuated. *Treatment of stump,* marsupialization. *Result,* recovery. *Remarks.* Ten pints fluid removed.

CASE No. 18.—*Reference,* Pozzi, *Gazette Méd. de Paris,* June,

30, 1888; also *Cong. Franc. de Chir. Proc. Verb.*, 1888, in *Boston Medical Journal*, April 28, 1892, p. 545. Female, aged thirty-four years. *Nature, size, and duration,* large echinococcus cyst. *Method of removal,* scissors. *Treatment of stump,* ligature, thermocautery, suture of liver in abdominal wound. Drainage. *Result,* recovery. *Remarks,* Discharge of bile and renewed liver tissue through drain.

CASE No. 19.—*Reference,* Smith, *Lancet,* February 18, 1887, Vol. i, p. 265. Female, aged forty-eight years. *Nature, size, and duration,* suspected hydatid cyst containing six ounces of fluid; five months' duration. *Method of removal,* No. 1 trocar and canula inserted into centre of fluctuating area. *Result,* rapid recovery. *Remarks.* No hooklets found.

CASE No. 20.—*Reference,* J. Chalmers Da Costa, present paper. Female, aged twenty-nine years. *Nature, size, and duration,* suppurative hydatid cyst. *Method of removal,* incised. *Result,* death.

Dr. Loux also submitted the following table showing the relative fatality when cysts are left to burst spontaneously, compiled by Cyr and published in the "Annals of Universal Medical Sciences," 1888, page 331.

In cysts bursting into peritoneum, 90 per cent. are fatal; into pleura, 80 per cent.; into bile ducts, 70 per cent.; into bronchial tubes, 57 per cent.; into stomach, 40 per cent.; into intestines, 16 per cent.; through abdominal walls, 10 per cent.

DR. W. M. L. COPLIN said that most of the echinococcus cysts which are met with by pathologists in this country are inspissated, that is, the parasite is dead, the fluid more or less completely absorbed, and the cavity occupied by a mass of detritus resembling the product caseation. Such cysts are not infrequently found post-mortem. In the last few years he had seen maybe four or five. The form of cyst that would be of interest to surgeons is the kind presented by Dr. Loux,—the true hydatid. Of these he had been fortunate enough to see a number. He had also seen one or two operations done with the belief that a hydatid was present, and although present it was not found. He recalled one in which numerous exploratory tappings were made without finding fluid, although Professor Bartholow was sure of the diagnosis. He followed the patient until he died and made the post-mortem. He found a cyst which contained a gallon

of fluid. The entire liver was in front of the cyst. Of course, all the tappings had been made into the hepatic structure. It was a case in which it would have been necessary to go entirely through the liver to find the cyst cavity; it could have been reached from behind. The cyst was unilocular, a simple hydatid. More commonly the cyst contains daughter and, quite often, grand-daughter cysts.

Of the symptomatology of hydatid cysts little is known. The patients of whom he had had any knowledge always complained of some digestive disturbance. The danger recognized by the older writers and by many of the older surgeons, where operation was never thought of, was suppuration. But why should suppuration occur? Commonly the cyst will form and progress with but few symptoms, or it may be none at all, and then suddenly all the phenomena usually associated with an intense infective lesion of the liver will occur. The suppurative process is shown by the usual evidences of intense infection. An operation at this time usually shows a suppurative cholangitis; sometimes the gall-bladder is involved; but usually it is a suppurative cholangitis following the course of the larger biliary ducts, even involving the smaller canals, and is occasionally mapped out upon the surface of the organ. Sometimes on the surface of the liver will be seen faint pencillings, the lines of infection as they travel along the course of the biliary and interlocular tissues. Commonly the lines of suppuration follow the course of the biliary canals. Investigation into the case to which he referred had led him to believe that the suppuration has not originated in the cyst, as was the older view, but that it is a suppurative cholangitis pure and simple. What relation the cyst has to it he did not know, unless it is that the cyst is a source of obstruction. We know that an obstruction of any amount in the gland is commonly followed by suppuration, often resulting from the most trifling causes. Very often a history of trauma in these cases is followed by suppurative cholangitis.

In the present cyst he had been able satisfactorily to demonstrate the brood-capsules with their contained scoleces. The capsules are all ruptured, but the scoleces are still in position. The specimen came into the laboratory at a time when the laboratories were in process of reconstruction, the buildings were torn down, and he could not try feeding experiments, but he did not doubt

that all the scoleces were still living. As illustrating the fact that where the patient develops hydatids without suppuration, or without inspissation or death of the parasite, there is absolutely nothing to hope for in any other treatment than that afforded by surgery, the observation of Leidy should be recalled. A cadaver came to the dissecting-room in the University. A student called Professor Leidy's attention to the cyst, and he was able to demonstrate that the brood-capsules were still living and able to infect, although the body was injected with chloride of zinc and had been preserved for a considerable time. Of course, if one cannot reach the parasite in the liver when a body is injected with chloride of zinc, post-mortem, not much can be expected from medical treatment during life. The usual course in nearly all of these cases is, with a trifling injury or without it, a suppurative cholangitis which terminates fatally. He had never known of an instance of suppurative cholangitis, of this origin, where the patient recovered.

PANCREATIC CYST.

Dr. John B. Deaver reported the case of a woman, aged fifty-eight years, who was admitted to the German Hospital, August 2, 1899, on account of an illness which had been developing during twelve or fifteen years. At first she noticed that she was losing her shape and was becoming stouter. This has kept up until the present time. She has always had regular habits; has never had attacks of epistaxis or hæmatemesis. Has suffered from small bleeding hæmorrhoids ever since the age of eighteen years. During the past few years has always been constipated, and at times has had some frequency and difficulty of micturition. Two years ago had a prolapse of the vagina, since which time she has used a vaginal stem pessary, which has relieved her. With all the above trouble she has felt in the best of health, took exercise regularly, and has always had a moderately good appetite.

On admission her temperature and pulse were normal. Heart and lungs clear. Her abdomen was greatly enlarged; fifty-two inches in circumference on a level with the umbilicus. The superficial veins were enlarged and tortuous, with apparently an increased fulness upon the right side high up. There was a general fluctuation, with deep-seated tympany in the right flank, with dulness but not flatness in the left flank, flatness anteriorly over the abdomen reaching as high as the ensiform cartilage;

the area of dulness not changed by any change of position. At a point two inches below and one to the left of the ensiform cartilage a thin plate of cartilage could be felt, apparently situated somewhat deeper than the abdominal wall. The liver was slightly diminished in size, and was pushed up as high as the fifth interspace anteriorly. Heart sounds, good; apex beat pushed slightly upward and to the left.

Operation, August 23.—Upon opening the abdomen, four gallons of a yellowish oily serum were evacuated, and a large cyst was revealed high up beneath the liver on the right side. The cyst was post-peritoneal, and was found to be adherent to the anterior abdominal wall. The peritoneal cavity was swabbed out with large pieces of sterile gauze; when dry it was packed with sterile gauze to maintain pressure upon the abdominal vessels. The abdominal incision was then continued upward to the left of the umbilicus, reaching within two inches of the ensiform cartilage. The abdomen was further explored to determine the advisability of removal of the cyst. Abdominal protective gauze removed and abdominal wound closed with drainage of pelvis. Cyst aspirated and about 500 cubic centimetres of fluid removed, the remaining portion being too thick to flow freely. The cyst wall was incised for a distance of one and one-half inches, allowing fully two and one-half quarts (2500 cubic centimetres) thick, fatty, yellowish fluid to escape (the cyst was about ten inches in diameter); its walls were thick and fibrous; at points there existed plates of cartilage which projected into the cavity. The cyst cavity was sponged dry, and finally packed with four large strips of iodoform gauze. A glass drainage-tube was inserted. Recovery followed.

Dr. Deaver said that the remarkable point in this case was that this trouble dated back twelve years, and, barring the size of the abdomen and the discomfort referred to the vagina and bladder and due to the pressure of the intra-abdominal fluid, she did not suffer any inconvenience; the bowels were regular; appetite good; she slept well, and, notwithstanding the fact that the heart and lungs were trespassed upon, she suffered no inconvenience referable to the chest. He had seen the patient recently, and found her feeling perfectly well.

Dr. Thomas S. K. Morton reported that the case of pancreatic cyst which he detailed to the Academy, March 6, 1899 (Annals of Surgery, June, 1899, p. 760), was still doing ex-

cellently. It was now more than eighteen months since the operation, and she had, some six months since, given birth to a healthy child. The cicatrix remains firm, and she experienced no complications or discomfort from her old trouble with the pancreas during or after the pregnancy. She has gained and retains much flesh.

CARCINOMA OF THE BREAST.

Dr. John B. Deaver presented a specimen of carcinoma of the breast removed from a woman, aged twenty-two, saying that the only point regarding the specimen of interest, other than the removal of the breast from so young a person, was the manner of removal. He cut wide of the growth, dissecting down on the great pectoral muscle, removing the sternal portion of it with the lesser pectoral, cleaning out the armpit, following up the vessels to the lower border of the collar-bone, the last step being the removal of the breast. The glands as far up as the collar-bone were infected. He had been struck by the amount of usefulness of the arm that shortly follows such operation. That is a point about which he was a little sceptical when he read the early reports of these operations to the effect that the function of the arm was very good. But he had the opportunity of observing one young woman who was operated three years ago and afterwards was employed in the German Hospital laundry. She could do as much work with the arm of the same side from which the breast was removed as she could with the other arm. He insists upon the patient using the arm.

As to the œdema which frequently follows the operation. Immediate œdema is not due to pressure on the axillary vein, but to the lack of support occasioned by the extensive dissection; œdema making its appearance later is usually the result of pressure upon the axillary vein from recurrent wall. He had seen a number of instances where œdema has appeared early; this has prompted him to allow the patients to use their arms early.

Dr. W. M. L. Coplin said that he had had an opportunity to watch a number of these cases dating back to the early "dinner-plate" operation of the late Professor Gross, for whom he did pathological work. The later results, statistical and from a pathological stand-point, fully justify the wide operations which modern surgeons are making. The necessity of avoiding the track of invasion, from a pathologist's stand-point, is eminently proper. No matter whether one believes in the microbic origin of car-

cinoma or that it is a form of cellular parasitism, the track must be avoided. A surgeon would not think of making an amputation through the line of infection if it could be avoided, and the wisdom of avoiding the track of invasion in cancer seems to be equally important.

There is one point with regard to these tracks of invasion which physiologists have only partly worked out, viz., anomalous distribution of the lymphatics or unusual lymphatic connection. He had seen one case of anomalous track of invasion in which primary cancer of the lower and outer quadrant of the mammary gland was associated with glandular enlargement in the supraclavicular fossa without axillary involvement. The patient was first operated on in Europe, and was afterwards in charge of the last Professor Gross. In this case the axilla was cleaned out,—the second operation,—and there was no axillary glandular involvement, although such involvement was present along the course of the lymphatics above the clavicle and in the gland back of the sterno-cleido-mastoid muscle. Cancer is also seen occurring in the genital organs and associated with retroperitoneal invasion, the glands of the groin escaping. Such anomalous distribution of the lymphatics and distribution of recurrences are probably to be accounted for as due to congenital peculiarities, although the view may be taken that occlusion of the lymph stream travelling towards the axilla may lead to collateral dissemination.

CARCINOMA OF THE RECTUM.

DR. DEAVER presented four specimens of carcinoma of the rectum, all removed by a modified Kraske operation. All made uneventful recoveries. Two of the patients in whom he succeeded in suturing the divided bowel had sphincteric action; the other patients had not. He had already put himself on record as against preliminary colotomy in an operation for the removal of the rectum in the majority of cases. None of these cases were very sick after the operation. He had never seen the loss of very much blood in this operation, and he thought that the reason of this was that he took out the lower three or four segments of the sacrum, dividing the bone transversely with chisel; then with a pair of scissors curved on the flap, hugged the under surface, cutting the ligaments and dividing the blood-vessels near their termination.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

Researches on the assumed Contagiousness of Erysipelas. By Dr. Wilhelm Respinger (Basel). The well-grounded teaching of the contagiousness of erysipelas is based on the epidemics prevalent in pre-antiseptic days as well as on its diminution, save in sporadic form, since the antiseptic era, and, finally, on its prevalence alongside of certain specific wound infections, *e.g.*, puerperal fever and cellulitis, which have turned out to owe their origin to a common micro-organism. This micro-organism has subsequently been found in rooms occupied by erysipelas patients.

Just how the contagium is disseminated has not been proven. In cases where the erysipelas followed in the wake of an open infected wound, direct infection is evident, and its spread to others under such circumstances is dependent on the contamination of dressings and utensils; wherefore the finding of cocci in such quarters tenanted by erysipelas patients has rightly been attributed to a possible desiccation and dissemination of the germs from dressings and the bedding.

In view of the fact that a large number of cases of erysipelas exist without a wound, just how these are responsible for propagating the contagium when it is recalled, that the process is a lymphangitis, at first sight appears mysterious. The author has therefore sought to prove by experiment that the contagion was spread by the dissemination of atomized particles of the scales which result from the desquamation or from the atomization of the contents of vesicles. Von Eiselsberg found this to be the case.

Against this the author contends that his cases were accessory to wound infections. To eliminate such infection of scales per continuity, the author chose only idiopathic cases, and in no instance did he succeed in gaining streptococci from the scales; whence he concludes, that these being the only channels by which the contagium can in any atomized form leave the intact skin affected with erysipelas, the latter cannot be classed *strictu sensu* as contagious.

The contagium streptococcus always gains its entrance by a wound, however small. At this site the virus is particularly virulent, and its contagiousness is to be viewed only in the same light as any other wound infection. Thus, with erysipelas placed in the same category as streptococcus abscesses and cellulites, the latter, with their exposed surfaces, are infinitely greater purveyors to the spread of this infection than an ordinary facial erysipelas. Treatment should none the less be carried on under the strictest antiseptic precautions; but in this light there ought to be as much obligation to report a streptococcus abscess as an erysipelas to the health authorities.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 2.

VASCULAR SYSTEM.

I. Circular Suture of Blood-Vessels in Man. By Dr. Kuemmel (Hamburg). The author very briefly reviews the history and the experiments bearing on the circular sutures of vessels in animals as conducted by Jossinowski, Heidenhain, Abbé, and Murphy. Encouraged by their results in animals, and the successful application of the lateral suture in man to the common iliac (Israel), common femoral (Lindner), axillary (Heidenhain), femoral artery and vein (Von Zoege, Manteufel, and Murphy), the author, for the first time, attempted the circular suture in man.

The first case embraced a resection of five centimetres of a carcinomatous mass involving femoral artery, with end-to-end

suture of the vessel. In a second case, two centimetres of a carcinomatous vein were resected and sutured end to end.

The history of the former is as follows: A female, aged fifty-two years; carcinomatous glands in the right inguinal region; the primary growth subsequently found to be in the genitals, which were but slightly infiltrated. Extirpation of the glands. The femoral was seen to course through the tumor and felt to pulsate both distally and proximally from the growth. The vein for a distance of two centimetres was also involved. Four to five centimetres of the artery with the growth were resected. The upper and lower limits of the vessel were clamped with artery forceps protected with drainage-tubes. The lower level of the resection was one centimetre above the profunda. By extensive freeing of the vessel from its bed, and coupled with flexion of the thigh, the ends were approximated and the circular suture applied without tension. The suture was applied merely through the outer coats. There was slight oozing from the stitches, and the current was at once established. The line of suture was still further protected by a muscle-flap. The wound was tamponed. The diseased vein was subsequently to be removed. In a few days the vein thrombosed, œdema set in; yet the wound healed in its greater extent by primary union. Recurrence, however, set in within a few weeks, and four months later the patient died from asthenia. A line of suture was not visible at post-mortem, but a clot of blood extended proximally as far as the iliac. The second case was also a carcinoma of the inguinal glands, which surrounded the vein but left the artery free. With the same precautions to guard against hæmorrhage, two centimetres of the vein were resected, with the exception of a small strip of the posterior wall two millimetres in length. End-to-end suture was performed, some of the sutures penetrating the wall. The free oozing which followed was controlled by additional sutures and the application of a muscle-flap. The circulation was immediately established. The sutures(?) were removed after

ten days; primary union ensued. The thigh was kept flexed for three weeks; thereafter it was extended, and the patient discharged on the twenty-fourth day.— *Beiträge zur klinische Chirurgie,* Band xxvi, Heft 1.

II. Suture of Arteries. Dr. Julius Doerfler (Rostock) reports two successful cases of suture of arteries performed by Barré. In the first instance, a continuous silk suture, embracing adventitia and media, was applied laterally to the internal carotid injured in the course of the extirpation of carcinomatous glands. Result: primary union; but at the post-mortem, three months later, inspection of this vessel was overlooked (?).

On a second occasion for a traumatic aneurism of the brachial, four interrupted silk sutures penetrating the intima were applied to the wound of the brachial, embracing half of the anterior circumference of this vessel. Result: primary union: pulsation in the radial and ulnar weaker than the opposite side, and a distinct pulsation was visible below the site of suture.

These two cases bring the number of successful artery sutures recorded in literature up to nine. No failures have at least been published.

Experimentally, the author has determined that an aseptic thread jutting into the lumen does not cause any interference with the patency of the vessel; therefore he sees no danger in having the suture penetrates all the coats of the vessel. Any oozing from the needle punctures not controllable by pressure can be mastered by suture of the vessel sheath, or by covering it with an adjoining slip of muscle or fascia. Wounds of greater extent than half the circumference call for the Murphy invagination method.

Indications for suture are: Accidental wounds, stab, gunshot, or lacerated wounds; injuries inflicted during operation; traumatic aneurisms. Rigid asepsis is a requisite for successful suture; therefore an infected wound offers no field for this procedure. Whereas the skin incision should be free to gain access to the vessel, the sheath should be spared as much as possible,

and the vessel itself subjected to as little stretching as possible. To render the vessel free from blood, proximal and distal pressure digitally is to be preferred; this failing, strips of gauze or forceps covered with rubber have to be used. Cambric needles armed with silk proved most useful for suture. Twelve experiments on animals performed with these precautions proved successful.

The Murphy method of invagination is indicated when more than half of the circumference is implicated, or when the laceration is extensive, or when traumatic aneurisms are not amenable to ordinary suture, or when a vessel has to be resected in the course of removal of new growths.

The author is wholly in favor of the invagination method as based on the successful outcome of his animal experiments and the three successful results in man. A particularly grateful field is augured for this method in aneurisms.—*Beiträge zur klinische Chirurgie*, Band xxv, Heft 3.

MARTIN W. WARE (New York).

HEAD AND NECK.

I. Microcephalic Idiocy and its Operative Treatment after the Method of Lannelongue. By DR. LOWENSTEIN (Heidelberg). Following the unsuccessful outcome of two craniectomies in two cases of microcephalic idiocy performed by Czerny, the author subjected 111 cases recorded in literature to a critical analysis. His conclusions may be thus summarized: Nineteen (17 per cent.) died from operation; twenty-five (22.5 per cent.), without any improvement; ten (9 per cent.), a slight but not satisfactory improvement; twenty-four (21.5 per cent.), improved; thirty (27 per cent.), improved in a general way; three (3 per cent.), no report.

Closer inquiry by letter from operators established the fact that these improvements were but apparent, and partly due to psychical reflex effects of the operation and the care incident to

it. Most noteworthy were the temporary abeyance of the epileptic attacks. Nearly every operator at this stage in the history of this operation has, after prolonged observation, seen the cases lapse to their original condition, so that the falsity of Lannelongue's hypothesis of premature synostosis as a cause of microcephalic idiocy falls simultaneously with the operation.—*Beiträge zur klinische Chirurgie*, Band xxvi, Heft 1.

II. The Operative Treatment of Spasmodic Torticollis. By Dr. Ernst Kalmus (Prag). Little attention having been accorded to the operations for the relief of this disease by German surgeons, the author has seen fit to bring to their notice the work of American and English surgeons. Recently, Woelfler performed accessory neurectomy on a female with temporary improvement. A year later he resorted to resection of the first, second, and third cervical nerves with ultimate success. Appended to this case is a thoughtful study and lengthy review of ninety-six cases. Herein it is found that the sterno-mastoid and the trapezius are most frequently affected. In such cases resection of the spinal accessory is most efficient. Failures to effect a cure are attributed to a faulty technic (for preferably the posterior border of the sternomastoid is chosen to perform the resection) or the subsequent involvement of other muscles. The most frequent cause of failure is the erroneous diagnosis that the deeper muscles are not involved. When the latter condition obtains, the deeper nerves of the neck ought to be singled out and resected. To accomplish this, the vertical incision of Noble Smith is preferable to the transverse incision of Keene, since the former splits the muscles in the plane of their fibres in the search of the nerves up to their exit from their foramina; whereas Keene, in addition, severs the muscles. Ligation of the nerve or nerve stretching, *per se*, or, as a preliminary, evulsion and simple division, seem no longer to be practised. A most favorable word is spoken for Kocher's division of the muscles with or without division of the nerves (Richardson and Watson) as the best procedure.

In short, which is the operation of choice is a moot question; however, the indication for any operation only arrives after remedials have failed; then the first place is assigned to such instances as those in which the spasm involves one or two muscles of the same side; when muscles of both sides are involved the case is hopeless. Cases of "retrocolic spasm" are best treated by nerve resection.

The statistical *résumé* is as follows: Accessory stretching eleven times, with three cures; resection sixty-eight times, and twenty more or less improved. Of these, in fifteen instances, a subsequent neurectomy was performed thirteen times with ten cures and three improvements, and twice sternomastoid myotomy was successfully carried out.

Finally, there are two cases in which neurectomy was performed primarily; thus affording a total for neurectomy of seventeen cases with eleven cures, which compares very favorably with de Quervain's analysis of Kocher's operation of twelve cases with seven cured.

Prognosis.—A satisfactory and lasting result may only follow after the lapse of many months. On the other hand, other muscles may become involved at this time. In such instances cortical or spinal centres must be involved.—*Beiträge zur klinische Chirurgie*, Band xxvi, Heft 1.

MARTIN W. WARE (New York).

ABDOMEN.

I. Fat Necrosis of the Pancreas and the Abdominal Fat. By DR. WAGNER (Karlsruhe). To the comprehensive picture of this disease rendered by Körte the author has merely to offer his own personal experiences in five cases, together with an analysis of eight recent cases reported in the current literature; all terminated fatally. In none of these instances was the diagnosis made, for in the present state of our knowledge merely a presumptive diagnosis might be offered in any case, since the

symptom complex is identical with that of intestinal obstruction. The cases suitable for operative treatment are those that survived the severe abdominal shock of the acute stage.

Bearing on the etiology, the familiar factors of endarteritis, interstitial inflammation, hæmorrhages (traumatism), are mentioned as "causa sufficiens," and infection as a "causa probabilis." The author's conclusions are thus summarized: The pancreatic diseases are the cause of fat necrosis. The pancreatic necrosis is caused by interstitial inflammation, atheroma, hæmorrhages, trauma, and exceptionally by extension of the inflammation from adjoining viscera.

Decomposition of the pancreas is caused by the migration of germs from the viscera. Of the pancreatic diseases, necrosis of this gland is the cause of fat necroses. The finding in a single instance of a germ (Bacillus coli commune) is not sufficient cause to assume a bacillar nature for this affection. Finally, the influence of the pancreas on the surrounding fat tissue is caused either by direct contact of its secretion with the latter, or in some obscure interdependence of fat and pancreas similar to that of the thyroid thymus, and suprarenal to their respective tissues. —*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 1.

II. Tuberculosis of the Abdominal Muscles. By Dr. Theodore Hiller (Stutgart). Conjointly with six other cases culled from the literature, the author relates his personal experience of a primary muscle tuberculosis in a girl twenty-seven years of age. The right rectus was the seat of the lesion, which was diagnosticated as cholecystitis. The error became manifest upon operation. In the aforesaid muscle a large cavity containing cheesy pus was encountered, and its wall was studded with tubercles. A sinus subsequently remained, requiring curetting. The moot question in all of these cases is whether the lesion is not an infection per continuity from a contiguously affected organ or a metastatic process. These being excluded, there remains to prove whether the cold abscess emanates from the connective tissue or

the degenerated muscle fibre. Traumatism could never be reasonably traced as a factor, and more frequently the tuberculous process went on to abscess formation.

The abdominal muscles were in all instances affected, and in the following order of frequency: oblique, transverse, and rectus. The site of the lesion was three times about Poupart's ligament, three times about the umbilicus, and three times in the region of the gall-bladder.

Diagnosis is at all times tentative, and regional affections have always to be positively excluded, since the symptoms may be common and peculiar to any of these. In nearly every instance a circumscribed painless tumor was encountered, but in only a small percentage could the tumor be localized to the abdominal muscles. The treatment was the same as that of tuberculosis encountered anywhere else.—*Beiträge zur klinische Chirurgie,* Band xxv, Heft 3.

III. Experimental Research concerning the Various Methods of Intestinal Suture. By Dr. V. Chlumsky (Breslau). The experiments were directed to determine the strength of the adhesion in intestinal anastomosis at various intervals of time. The healthy gut of a living dog withstood a hygrometric pressure of 500 millimetres. Beyond this the peritoneum tore first, then the circular followed by the longitudinal muscular coat, and, lastly, the submucosa. In the fresh human cadaver but 200 millimetres of mercury sufficed to produce the same results.

When anastomosis was performed in dogs, whether sutures or buttons were used, 150 to 200 was the limit of hygrometric pressure endurable. In suture anastomosis leakage occurred through the stitch-holes, and end-to-end anastomosis withstood greater pressure than the lateral.

Manometric tests showed the impermeability at the line of anastomosis progressively diminished within the first four days. Five days after operation, a slight increase in the impermeability

set in, and by the eighth day the pressure at the line of suture withstood nearly that of the normal gut, and by the tenth day absolutely that. About eighth day suture anastomosis made a slightly more favorable showing against pressure than button anastomosis, but all this was equalized in the next few days. In the early days, however, the showing favors the button. In button anastomosis the leakage occurs at irregular sites; at points of adhesion, about the purse-string suture, at places where pressure necrosis ensued. In suture anastomosis leakage always occurred at the site of the knot.

The hypercritical and derogatory remarks concerning Murphy's button, however, do not bear out the author's actual experiments. He would reserve the button where rapid work is necessary in weak individuals, or where the depth of organs calls forth technical difficulties; quite naturally Frank's button is also condemned. In suturing, No. 1 silk alone is used. Two tiers were always employed, and, to insure perfect adaptation at the mesenteric border, the mesentery is dissected off for five millimetres, and interrupted sutures applied to the bowel at this site.

In the after treatment, fluids should be given until the eighth day, then solids. At the time (fourth day) when the impermeability is at its ebb, violent motion should be at its minimum, and only after the eighth day should the erect position be assumed, and not till the fifteenth day should any great expenditure of force be allowed.—*Beiträge zur klinische Chirurgie*, Band xxv, Heft 3.

MARTIN W. WARE (New York).

GENITO-URINARY ORGANS.

I. Urachus Fistulæ. By DR. A. JAHN (Breslau). In conjunction with the report of the following case, a number of facts bearing on this malady are elucidated. A boy, five years of age, shortly after and ever since birth passed urine from the umbilicus. A probe five millimetres thick enters the bladder, where

contact with the sound introduced by urethra is felt. Examination by cystoscope introduced by way of the fistulous tract shows the interior of the bladder to be normal, and a slight diastasis of the recti muscles to exist. The operative procedure with which Mickulicz is credited as originator(?) consisted in the extirpation *in toto* of the entire tract to the bladder with suture of the bladder defect and drainage of the wound. Such a radical procedure is not well borne by infants, and is only to be resorted to after their first year, during which period cauterization or partial resection ought to be practised. Apart from the deterrent factor of age as limit to this operation, the impossibility to avoid injury of the peritoneum is not, so long as this is instantly recognized, forthwith sutured and drained, but a complicating cystitis is of course a contraindication to such a procedure.

The aforesaid concerns congenital urachus fistulæ. The so-called acquired form, however, has its origin in the same anatomical structure (round ligament), which remains partially patent near the bladder. To still further distend it by back pressure requires the stasis of urine incident to interference of the urinary circulation as caused by stricture, enlarged prostate, stone, and urethritis. Thus it is manifest that in the congenital variety the cystitis is caused by repeated probing and cauterization of the wound, whereas, in the acquired form, the cystitis is the primary factor.

Diagnosis.—The discharge of urine, while it offers the most presumptive evidence of a urachus fistula, can also be due to an abscess in the prevesical space, due to an extraperitoneal rupture of the bladder. Other fistulous tracts presenting at the umbilicus are, amputated sac of umbilical hernia, intestinal fistula, and an opening of a Meckel's diverticulum. Finally, it has been shown that it is possible for inflammation to spread from the bladder wall by lymphatics along the round ligament, thence to discharge at the umbilicus, wherefore the only conclusive proof of the origin of the fistula is a microscopic examination, which must reveal as

the interior of the tract a layer of pavement epithelium.—*Beiträge zur klinische Chirurgie*, Band xxvi, Heft 2.

II. Carcinoma of the Penis. By DR. H. KUETTNER (Tübingen). This article purposes to show the special mode of progression and dissemination of this carcinoma by the lymph channels as based on the pathological data of sixty cases in Bruns's clinic, as well as anatomical research undertaken to formulate a rational prognosis and therapy.

The epithelioma once having passed the limits of the tunica albuginea proliferates in the wall of the veins (endarteritis carcinomatosa), causing an obliteration of the lumen (Geschwulstthrombose); yet, in spite of this intimate relation of these cavernous spaces to the epithelioma, no hæmic metastases have occurred. This epithelioma shares with others of its class the little tendency to any visceral metastases. Only ten cases are accounted for in literature where such metastases occurred. Author narrates one of his own (lungs). On the other hand, local glandular metastases sooner or later result. The inguinal glands are first affected, and subsequently the pelvic, hypogastric, and lumbar, though twice at the clinic the latter were first involved.

From injection specimens of the fœtus and the new-born the following facts obtain in regard to the lymphatic drainage of the penis. The lymphatic network of the two halves of the penis freely anastomose. The efferent lymph-trunks often empty by branches to glands of either side. The lymphatic glands of the prepuce, glans, and urethral mucous membrane anastomose. The majority of the lymphatics, superficial and deep, empty into the inguinal glands; exceptionally, the deep lymphatics empty into the hypogastric glands, or, circumventing the inguinal glands, empty direct into the lumbar glands.

Glandular enlargement is found to occur late in the disease. It occurred in 71 per cent. of the cases, and in only 32 per cent. of the total number were they carcinomatous. Of the sixteen

cases free from recurrence, none had any glandular enlargement in spite of the advanced state of the epithelioma at the time of operation. It is of further import to hear it stated that in the majority of instances the glandular enlargement is inflammatory (serial section), and undergoes regressive changes.

Prognosis.—On the whole, it is the most favorable of carcinoma to attack, since, on anatomical grounds, the entire affected region may be extirpated. A small growing carcinoma with large glands is the worst type.

The end result of sixty cases is as follows: Twenty-three are discounted; because of death, three; limited observation, nine; inoperable, seven; no information, four. Of thirty-seven remaining, fifteen (45.5 per cent.) recurrences, twenty-two (59.46 per cent.) cures. Of the latter nine remained free from recurrence for a period varying from three to twenty-nine years. Two cases operated on at the advanced age of seventy are still living ten years later.

Very early local recurrences are the rule. On account of the depressing mental effects, emasculation is not recommended, but simple amputation or ablation of the penis is preferred.

Etiology.—Immunity towards carcinoma on the part of circumcised individuals is not proven. Histologically, the carcinoma are of epithelial papillary type. The histories of sixty cases are appended.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 1.

MARTIN W. WARE (New York).

REVIEWS OF BOOKS.

RETROPERITONEAL HERNIA. By B. G. A. MOYNIHAN, M.S. (Lond.), F.R.C.S.(Eng.), etc., Assistant Surgeon Leed's General Infirmary. London: Bailliere, Tindall, and Cox. 1899.

This work contains the Arris and Gale lectures on the anatomy and surgery of the peritoneal fossæ delivered by the author at the Royal College of Surgeons of England.

The author takes up systematically the embryonal development of the intestinal canal and the peritoneum, and shows the origin of the various peritoneal fossæ. The fossæ of the various regions are discussed; first, the duodenal folds and fossæ are described, and the diagnosis, physical signs, and treatment of the duodenal hernias. The folds and pouches in the region of the cæcum and vermiform appendix are treated in the same way; and also the intersigmoid fossa and the foramen of Winslow.

Concerning retroperitoneal hernia of the vermiform appendix, the author shows that it is by no means an uncommon condition. The appendix may be herniated into the subcæcal or ileocæcal fossæ, partially or completely. Under the latter circumstance the organ may be completely out of sight. In one case reported by the author the appendix could be found only after the most careful search. He thinks that Lockwood's case of so-called absence of the appendix was such an one. The degree of this hernia may be very slight, and the appendix may seem to be buried in the wall of the cæcum for a short distance. These conditions, he shows, are responsible, in a large measure, for the deviations from the normal in the position of the organ. He says, "I do not propose to make any definite statement upon the fre-

quency of retroperitoneal hernia of the vermiform appendix, but I may mention that, speaking roughly, the condition may be said to exist in at least 8 or 10 per cent. of all subjects. That, I think, is rather underestimating its frequency; but for the present it may be held to be approximately correct."

The book contains reports of a number of cases and photographs of all of the specimens that exist in the museums of England and Scotland. The bibliography is particularly full.

This is a subject that has received too little attention from surgeons; and Moynihan has added a valuable contribution to its literature.

JAMES P. WARBASSE.

PROGRESSIVE MEDICINE. Edited by HOBART AMORY HARE, M.D. Vol. I, March, 1900, and Vol. II, June, 1900. Lea Brothers & Co., 1900.

Dr. Hare has said that it is with the object of presenting readable and useful material that these volumes are published; and every contributor to their pages has been asked to say what he has to say in a narrative form, and to place his hall-mark on the text, so that it shall be a story bearing a personal imprint, and shall express not only the views of the authors cited but the opinion of the contributor as well. All of this has been accomplished in no mean measure. The volumes appearing during the past year have been reviewed in these pages. The two volumes now before us represent the beginning of the second year.

Vol. I is devoted to the surgery of the head, neck, and chest; infectious diseases, rheumatism, pneumonia, and influenza; diseases of children; pathology; laryngology and rhinology, and otology. The surgical chapter is by J. Chalmers Da Costa, and treats of many of the same surgical diseases discussed by him in the corresponding volume of last year. It is of interest to observe the differences of views and teaching which the lapse of one year can make. "The administration of thyroid extract in Graves's disease almost always makes the patient worse, a

result to be inferred from the observation that healthy animals fed on thyroid develop many of the symptoms of exophthalmic goitre, and also from the known fact that the administration of thyroid extract in the treatment of obesity has occasionally produced what appears to be exophthalmic goitre." The author also calls attention to Pitres's treatment of exophthalmic goitre with injections of iodoform and ether.

This chapter contains an interesting discussion on the division of the pneumogastric nerve in the neck, showing that the division of one pneumogastric nerve can be carried out if surgical necessity requires it. A series of important cases are referred to. Under the discussion of carcinoma of the tongue the views of W. Watson Cheyne are important because of the thorough and radical measures to which he resorts in the treatment of this disease. In the first place, he considers that the tongue is about the worst place in which a cancer can arise. The mortality can be lessened if the mouth and teeth are carefully cleansed beforehand. Before removing the tongue, Cheyne has all stumps of teeth removed, and during two or three days immediately preceding operation he has the mouth and teeth scrubbed three or four times a day with an antiseptic powder and washed with a non-irritating antiseptic solution. The custom of Dr. Da Costa is to scrub the teeth with soap and water twice a day, and to wash the mouth, nares, and nasopharynx every three hours when the patient is awake, first with peroxide of hydrogen and then with boric acid solution. Thirty-six hours before operation, Cheyne injects twenty cubic centimetres, and twelve hours before operation ten cubic centimetres of antistreptococcic serum.

Another valuable discussion is that upon the best age for operating upon cleft palate and harelip. The views of Owen, who favors early operation, and Delbet, who operates between the sixth and seventh year, are discussed. The surgical treatment of empyema is brought up to date by a review of the recent papers on that subject. Several cases of double empyema treated by

operation are referred to; and in this connection the following statement from Treves is quoted: "It is a striking and apparently paradoxical fact that an operation opening both pleuræ, which if performed on the healthy would be invariably fatal in its effects, is a valuable means of saving life when employed in conditions of disease."

Foreign bodies in the bronchi and penetrating wounds of the thorax are treated in the light of the recent literature upon these important subjects.

The analysis of all that is known upon the subject of carcinoma of the breast is embodied in twelve pages of this book. It is the best critical *résumé* of this subject that we know of in the English language. It should be read by every student of surgery who would put himself in touch with the most advanced knowledge pertaining to this disease.

Dr. Da Costa treats the subject of wounds of the pericardium and heart in the same masterly way. The gleanings from the most recent literature upon this subject are presented. It is of more than scientific interest: it is fascinating to the degree of being dramatic. The surgeon who reads this recapitulation of what has been done in the treatment of wounds of the heart, and is moved by nothing other than pure scientific interest, is fit for strategies and spoils.

In the treatment of aneurism of the aorta the consensus of opinion leans strongly towards the use of wire. Da Costa combines it with electrolysis. The collection of views shows a pretty general condemnation of the operation of craniotomy for microcephalic idiocy. Surgical operations for insanity and upon the insane are discussed. A critical review of the subject of operations for trigeminal neuralgia is given, involving, as it does, the strong advocacy of removal of the Gasserian ganglion by Keen and Spiller and the unqualified condemnation of the operation by Senn.

The chapter on pathology by Ludwig Hektoen contains much

of surgical importance. That the author is wiser in his own generation and specialty than many of his *confréres* is evidenced by the following: "I have good and sufficient reason to believe that the announcement by Brá, in Paris, of the discovery of a fungus in cancers, which has been extensively noticed in the medical press, is nothing but an annoying bit of charlatanry, wholly unworthy of the publicity it has received."

Vol. II contains chapters on the surgery of the abdomen, including hernia; gynæcology; diseases of the blood, diabetic and metabolic diseases, diseases of the glandular and lymphatic system; and ophthalmology. The surgical chapter is by Dr. Coley, and opens with the subject of gastroptosis. A full discussion of the operations upon the stomach is given. In the treatment of perforating gastric ulcer the words of Lennander are worth repeating: "The first essential in order to save a large number of patients suffering with severe abdominal symptoms is, that we physicians cease to believe that it is our first duty in these cases to relieve pain. On the contrary, we should, from the character of the pain, form a diagnosis; the important part of which is, 'in this case we should operate immediately,' or 'in this case we should not operate, at least not immediately.' If we begin with a large dose of morphine or with hot compresses we delude the patients with hope, which, in the majority of cases, rapidly disappears when the distention of the abdomen denotes the presence of a diffuse peritonitis." Of the diagnosis of perforation, Richardson says that with a definite history of gastric ulcer the diagnosis is easy. Bidwell's recent contributions on the subject are discussed, also Petersen's on the operations for non-malignant disease of the stomach. Concerning gastro-enterostomy, the progress of the operation is shown by the statement of Petersen that at Czerny's clinic in simple cases the mortality prior to 1895 was 25 per cent., while since 1895 it has been only 3 per cent.

The subject of appendicitis is discussed, particularly in the

light of Richardson's recent paper read before the American Surgical Association. In spite of the rapidly increasing literature, the question of the time for operating is by no means settled. Richardson's views, however, come pretty near meeting with general surgical approval. We reiterate and urge the repetition of this of his conclusions: "The rule that needs to be constantly repeated is one that calls for the surgeon early in the disease. It cannot be repeated too often." Not only is a *résumé* of Richardson's paper given, but the discussion following its presentation is also discussed. The author of this chapter gleans not only from current periodical surgical literature, but refers also to McBurney's views as expressed by him in the "International Text-Book of Surgery."

Bassini's operation is analyzed through the view-point of E. W. Andrews. The value of this system of presenting a subject is particularly evident in this chapter. Here are presented the views and experiences of three surgeons with regard to this operation,—Bassini, Andrews, and Coley: the latter discusses the views of the second concerning the operation of the first. The result is admirable and satisfying. This chapter also reviews Bloodgood's report of 459 operations for hernia, and also presents the author's experience with 700 cases.

A service of great value has been done humanity by the reports from the Johns Hopkins Hospital on the use of local anæsthesia in minor and major operations. During the past eighteen months 200 cocaine operations have been done in that hospital. Among them were thirty laparotomies, two gastrostomies, three cholecystotomies, for empyema of the gall-bladder, three appendectomies, and one closure of traumatic rupture of the jejunum. In operations upon the intestine, cocainization of the bowel has never been necessary. All of these cases healed by primary union.

Hans Kehr, of Halberstadt, has operated upon 406 patients for cholelithiasis. His reports upon this subject are analyzed.

M. L. Harris, on the diagnosis of abdominal tumors, offers material for an instructive and well illustrated chapter. The mesocolon naturally divides the abdomen into four spaces, he says, and by the inflation of the colon a diagnostic help is secured, of which surgeons make too little use.

Chapters upon the detection of calculi by the X-rays and upon the use and abuse of saline solutions add much to the value of the book.

The above constitute but an imperfect mention of a few of the features of this work. We have no word of praise too great for its style or for the fine judgment exercised in the selection of its constituent material.

JAMES P. WARBASSE.

LES PROJECTILES DES ARMES DE GUERRE: LEUR ACTION VULNERANTE. Par les Drs. H. NIMIER, Médecin Principal de l'Armée, Professeur au Val-de-Grâce, et ED. LAVAL, Médecin Aide-Major de 1re Classe. 1 vol. in 12 avec gravures. FELIX ALCAN, Éditeur. Paris.

In this small hand-book are reproduced the lectures delivered by the author as Professor at Val-de-Grâce. The work is divided into two parts,—infantry and artillery projectiles. In succession are considered the physical and dynamic qualities of each, their zones of action and of effect upon the human body as to infantry projectiles. Greatest interest at the present time naturally attaches to the effects of the small calibre-jacketed projectiles used in the arms now adopted generally in the armies of civilized nations. The conclusion of these French authorities seems to be in accord with American and British experience that wide-spread lacerations, so-called explosive effects, are rarer and less marked in the wounds made by the new projectiles than in those caused by the old-style balls. The conclusion of the authors is expressed thus:

"In fact, the difference between the action of the old and

the new projectiles is due to this, that in the old, owing to the larger surface of impact, their larger normal calibre, and the greater frequency of their accidental deformation, more favorable conditions were created for the extension to the tissues through which they passed of their destructive effects. On the other hand, the notably greater velocity at near distances of the new projectiles is not sufficient to compensate for the inferior wounding power due to their smaller calibre and freedom from deformation."

It is now evident, from abundant experience, that the surgery of the new projectile is of a simpler and more hopeful character than that which attached to the old, large-calibred, soft projectiles. The changes wrought in military affairs by the new arms are rather of a strategic than of a surgical character.

LEWIS S. PILCHER.

A MANUAL OF SURGICAL TREATMENT. By W. WATSON CHEYNE and F. F. BUYHARD. In seven volumes. Vol. III. Pp. 305, with 100 illustrations.

The third volume of this work (see ANNALS OF SURGERY, April, 1900) is devoted entirely to the surgery of the osseous system,—fractures, diseases of bone, and amputations.

This section of the manual is very good, and must prove of great practical value. As in the preceding volumes, there is still some tendency to dwell rather too much on certain old-fashioned apparatus and procedures, while some valuable "modern" methods are either treated too briefly or not at all. Although the X-rays belong properly to a treatise on diagnosis, it is surprising that this adjuvant to treatment fails of mention in this work.

The direct fixation of fractures by operative interference is considered very fully. It is rather to be regretted that the methods of pegging, wiring, etc., are so well illustrated and described, as they give the tyro a false impression of the useful-

ness of these procedures. The authors seem to use and recommend the use of bone chips for filling bony defects, while the majority of surgeons who resorted to this method eight or ten years ago have long since been disabused of their illusions concerning its usefulness.

Wyeth's bloodless amputation at the hip is not approved of by the authors. Properly adjusted, the pins usually secure perfect bloodlessness; but in the rare occasions where greater control is needed, direct pressure on the external iliac through a harmless "gridiron" incision is a most admirable measure, although not described by the authors. Objections to Pirogoff's operation prevent the authors from even giving a description of this valuable amputation. As modified by the Günther oblique section of the bone, the author's criticisms seem to be entirely unwarranted.

CHARLES L. GIBSON.

ERRATA.

IN Dr. Stimson's article on "Cubitus Varus" in the October number certain errors were made in numbering the illustrations which may mislead. Fig. 2 represents the same specimen as Fig. 4 and should be correspondingly numbered. The first specimen is not represented by an illustration; the reference of it to Fig. 2 should therefore be eliminated. "Fig. 5" should read "Fig. 7," and "Fig. 7" should read "Fig. 5."

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STRUCTURE, FRACTURE, AND REFRACTURE OF THE PATELLA.

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THE subject of fractures of the patella has attracted many writers, by far the majority of whom have confined their attention to the various methods of treatment, leaving the etiology comparatively untouched. It is, therefore, the latter part of the subject to which I wish to direct attention.

The bone may be broken by direct or indirect violence. It is the fractures that result from the indirect violence that are etiologically the most interesting. It is therefore instructive to examine the conditions as found in a biped and a quadruped, as the latter practically never breaks its patella. In the quadruped the bone exists in the extensor arc over the knee-joint, which is flexed naturally to an angle of about ninety degrees. In consequence, the body-weight will tend to flex the knee, and this tendency must be resisted by the extensor arc, including the patella. If the ligaments bore the strain, flexion of the knee would be limited to ninety degrees, which is not so. The patella must bear a constant strain, and will be a strong bone. In the erect position, the body-weight is transmitted directly from the femur to the tibia, leaving the patella comparatively functionless. As compared with a quadrupedal bone, the human patella is relatively thinner, broader, and has a far wider mesh-work in its internal structure. In examining clinical data, I could find (*Lancet*, October, 1898, and *Veterinarian*, January, 1899) no recorded case in which a quadruped broke its patella by indirect violence, and fractures by direct violence are extremely rare. On the other hand,

fractures of the patella form, according to Gurlt, 1.4 per cent. of all fractures, and to Makins and Abbott, 2.29 per cent. (St. Thomas's Hospital Reports, 1898, p. 475), and far the majority are caused by indirect violence. As would be expected, the explanations of these points are to be found in the mechani-

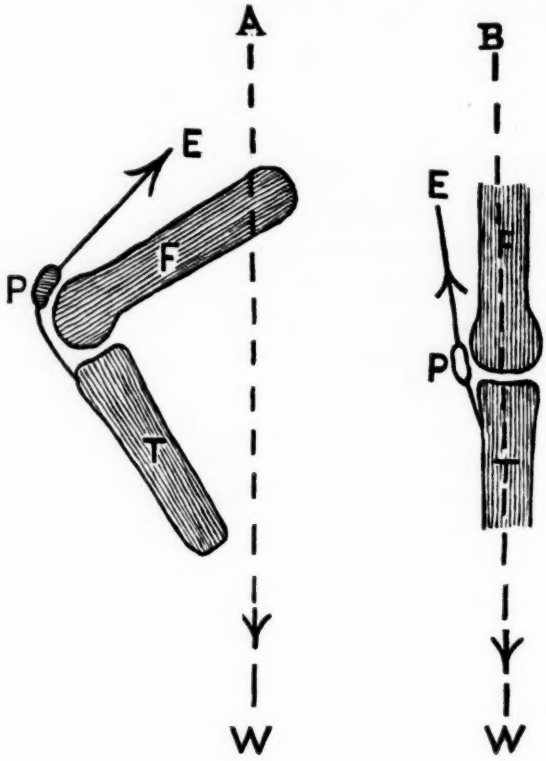


FIG. 1.

cal disposition of the parts. A quadruped has a long ligamentum patellæ that allows the strong patella to be supported throughout its length by the femur; in man, owing to the assumption of the erect attitude, the ligamentum patellæ is short, and the weaker patella lies low down on the femoral condyles, being only in part supported by the femur. In the latter the patella runs the risk, and is frequently broken across the lower end of the femur.

Fractures by direct violence are of very little interest etiologically, and it is the action of indirect violence that offers the most interesting problems. It has therefore been attempted in this paper to separate these two. At the very outset the problem arose as to whether any other than stellate fractures could result from direct violence. The patella is largely peculiar in that when submitted to a blow the femur acts as an anvil, and it is violently compressed between the "hammer" and the "anvil." The femur may be rendered firmer by the knee being flexed at the time of the accident. Under such circumstances, it is difficult to see how anything but a stellate fracture could result, and especially as the "anvil" is convex and presents a somewhat irregular curve. In two directions the above must be modified, viz., the extent of the areas over which the direct violence is diffused or applied, and the relations of the size of the "force-areas" to that of the "contact-areas" between the patella and the femur. To deal with the first of these, it may be stated that the greater the "force-area" the greater the likelihood of stellate fracture and comminution, and *vice versa*. With regard to the second, if the force-area equals or is greater than the contact-area, a stellate fracture will probably result. If, on the other hand, the force-area is less than the contact-area, a transverse or oblique fracture may result, and the smaller the force-area the more likely is this result to be attained. Such an accident as the last is of rare occurrence. There is also another class of fractures called "contusion fractures," where a blow is implanted on the lower end of the patella, the knee being flexed, which breaks the bone higher up. A transverse or oblique fracture will result, and is an example, undoubtedly a very rare one, of the action of indirect violence. Hence it shall be right, or at least most nearly so, in regarding all transverse and oblique fractures as the result of indirect violence. Besides the rare contusion fractures, indirect violence resolves itself into a violent contraction of the quadriceps extensor femoris or a comparatively passive resistance to the action of the body-weight.

In incidentally dealing with corresponding fractures of the

femur and leg bones, far more difficult cases arise for decision, and the figures must be received with caution, as they must be influenced by the personal equation. If they err, as they must, the error will be on the side of there being too many examples of indirect violence, and not to few.

Structure and Refracture.—As the internal structure of the bone is determined by the mechanical conditions under which it exists, sections were cut of human and quadruped patellæ in order to examine the architecture. As this point has been dealt with in a paper read to the Anatomical Society (abstracted in the Proceedings of Anatomical Society, *Journal of Anatomy and Physiology,* April, 1900), February,

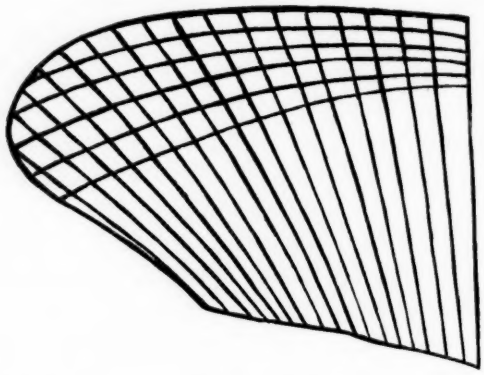


FIG. 2.—Diagram representing the structure of the apex of the human patella.

1900, a brief account only will be given, dealing with such points as may influence fracture. Professor Anderson, following Malgaigne, argued the existence of a diminished textural resistance in the bone, correlating this with the age, sex, and habit of the patient (*Lancet,* 1892, p. 10). Poirier, "Traite d'anatomie," 1897, says that the surrounding layer of compact bone diminishes in thickness as age advances. Beyond these references, nothing could be found that referred to the structure of the patella as likely to influence its fracture.

The accident of fracture by indirect violence is essentially human, and is connected with a relatively broader, thinner,

and weaker bone with a short ligamentum patellæ that causes it to lie relatively low on the femoral condyles and more directly over the joint.

On examining a sagittal section of the human patella it is seen that the anterior surface is composed of dense compact bone in which the fibres run parallel to the surface. At the upper end of the bone the compact layer is seen to arise at the insertion of the quadriceps extensor tendon. The deeper

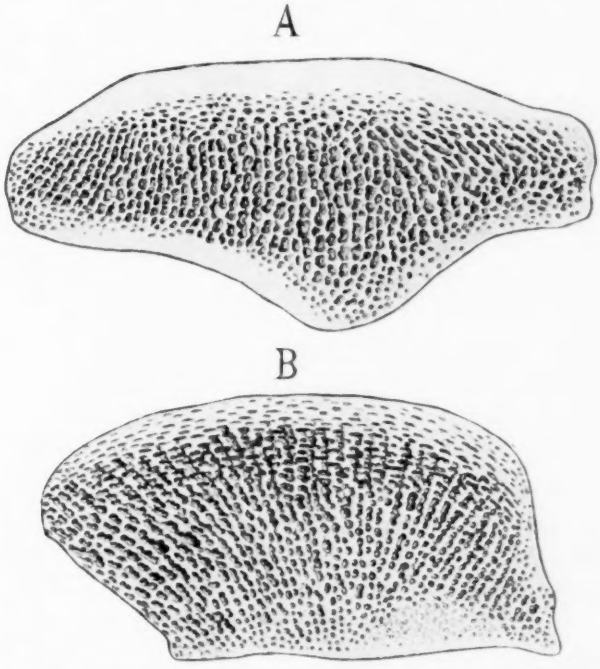


FIG. 3.—A, horizontal section; B, sagittal section of human patella.

fibres of this layer become farther apart from each other, and towards the lower end of the bone or apex fray out to form part of the interlacement in this part. Next to the articular cartilage, a smaller but similar layer of compact bone is seen, which is present in greatest thickness in the upper half of the bone. Connecting these two compact layers are a number of trabeculæ. Just above the centre of the bone these connecting fibres are approximately at right angles to the layers of com-

pact bone. As the apex is approached, they become more and more oblique, and in that portion they interlace with the frayed-out fibres of the anterior compact layer forming a meshwork. At the upper end of the bone a similar but opposite obliquity is observed in the connecting fibres, which is far less extensive than that just mentioned. The connecting fibres are closest together in the upper half of the bone, and towards the apex they are widest apart. At the extreme upper end of the bone they are also less close than at the middle.

The explanation for this architecture is that the fibres in the anterior layer of compact bone represent the lines of traction of the quadriceps extensor muscle; and it is interesting to note that by running over the anterior surface of the bone they gain the greatest leverage that the patella can give them. The connecting fibres represent the lines of pressure of the patella upon the femur. The distribution of the lines indicates that the patella is directly supported by the femur in the upper half of the bone, and that in the lower half the pressure becomes more and more oblique until in the apex the pressure and traction lines interlace, forming the best mechanical arrangement for strengthening a part unsupported by the femur. A similar argument may be drawn from the far shorter range of the oblique fibres at the upper end of the bone, but, comparatively speaking, these are of little importance.

From observation of the internal architecture of the bone, it will be seen that the lower half of the patella is weaker than the upper, and also that, as in the former, the direction of the pressure is oblique, fractures should be most frequent in this region. In order to test this point, I have examined the records of cases of fractured patella which occurred in the St. Thomas's Hospital practice in the ten years, 1890-1899 inclusively. In a number of cases the necessary data are vague, but I was enabled to gain data of 191 cases. These are classified under three headings,—the upper fragment is the larger, about the centre, the lower fragment is the larger. I have found that Hamilton (" Fractures and Dislocations"), on a smaller scale, has adopted this classification, and add his figures to the table.

St. Thomas's. Upper fragment the larger; 72 cases; 37.7 per cent. About the centre, 87 cases; 45.5 per cent. Lower fragment the larger, 32 cases; 16.8 per cent. Total number of cases, 191.

Hamilton. Upper fragment the larger, 22 cases; 48.8 per cent. About the centre, 16 cases; 35.5 per cent. Lower

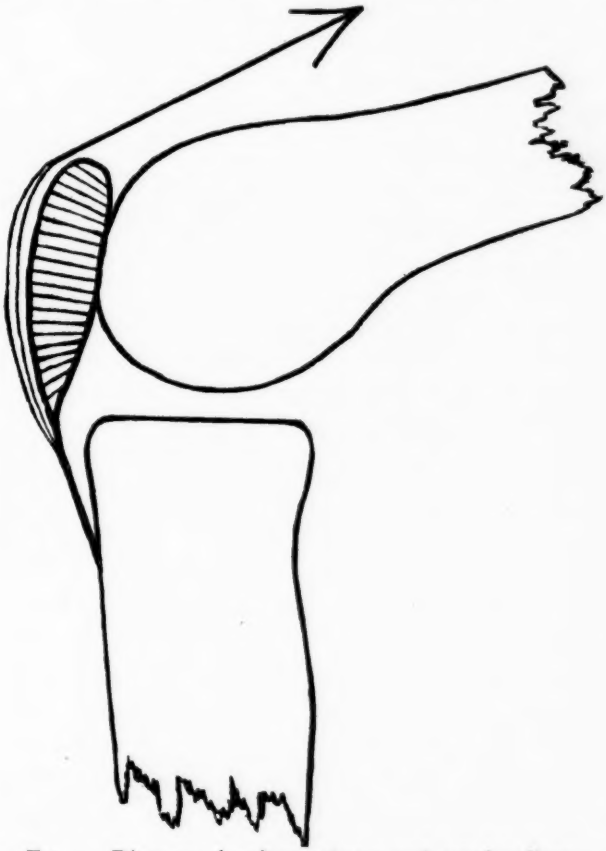


FIG. 4.—Diagram showing pressure and traction lines.

fragment the larger, 7 cases; 15.5 per cent. Total number of cases, 45.

From this table it is seen that fractures about the centre and in the lower half of the bone form no less than 83.2 per cent. of the St. Thomas's cases and 84.3 per cent. of Hamil-

ton's. Hamilton makes fractures in the lower half of the bone more frequent than at the centre, which the St. Thomas's records do not. The former table, being the results of one worker, has an advantage over the latter, which is obtained from the work of many.

Fracture of the patella by indirect violence is really due to an exaggeration of the natural mechanical forces that have given rise to the internal architecture of the bone, so that the structure of the bone should indicate the common situations of the fracture. And it has been shown above that the lower half of the bone is the weaker, and fracture occurs here in no less

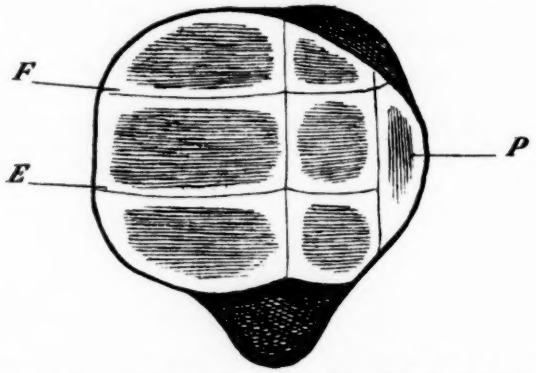


FIG. 5.—Showing facets on patella (after Macalister's "Anatomy"). *P*, area of permanent contact; *F*, flexion line, forming lower limit of flexion area; *E*, extension line, forming upper limit of extension area.

than 83 to 84 per cent. of cases. The structure of a quadrupedal patella goes hand in hand with the possibility of fracture. In this case the pressure lines extend from end to end of the section, showing that it is supported throughout its length by the femur, and, as has been shown, no case has been yet recorded of fracture having occurred through indirect violence (*loc. cit.*).

Besides the structures of the bone there is a still more important factor in localizing the situation of the line of fracture by indirect violence. This is the degree to which the knee is flexed at the time of the accident. As is well known, the articular surface is subdivided by a vertical ridge into internal

and external articular facets. The internal facet is further subdivided by a vertical or sometimes oblique line into two parts, the innermost of which I wish to call special attention to. It represents the portion which is in permanent contact with the femur during all movements of the joint.

Two horizontal lines divide up the articular surface except, as would be expected, the area of permanent contact. The upper of these forms the lower limit of the surface in contact during full flexion of the knee, and may be called the flexion line; the lower forms the upper limit of the area in contact during extension and slight flexion of the knee, and may be called the extension line. The part intermediate between these lines is that which articulates with the femur during semi-flexion. The centre-point of the bone varies a good deal, but, for practical purposes, may be said to be just below the middle of the area of contact for semi-flexion. As 84 per cent. of fractures occur about or below the centre, they occur during slight or semi-flexion, which certainly bears out experience.

Professor Macewen, in the ANNALS OF SURGERY, March, 1887, deals with the causation of transverse fracture by indirect violence, but has not considered the influence of the various contact-areas upon this line of cleavage. The most important area to consider is naturally that of permanent contact. If the knee is considered when in the position of slight flexion, the areas of the articular surface of the patella in contact with the femur will be that of permanent contact and that below the extension line (Fig. 6, C). As the contact-area (shaded) is oblique, so will be the line of the resulting fracture, and the direction of the obliquity will be from above downward and within outward. Similarly, when the knee is fully flexed, the contact-areas will be that of permanent contact and that above the flexion line, and the obliquity of the fracture will be from above downward and without inward. When the knee is semi-flexed, the line of fracture will probably be transverse.

According to this argument, oblique fractures should be fairly common, especially as far the majority (84 per cent.)

of fractures occur at or below the middle of the bone, and of these about half (Hamilton says more than half) occur below the centre, *i.e.*, when joint is presumably slightly flexed. On inquiry into the records, oblique fractures are few, and this may be partly accounted for by the fact that small degrees of obliquity are easily overlooked clinically. Hamilton's observations being made by one man are of particular value, and he found only four cases of marked obliquity out of 127, approximately 3.2 per cent. From the St. Thomas's cases, this would appear a good deal too low; but I avoid making a

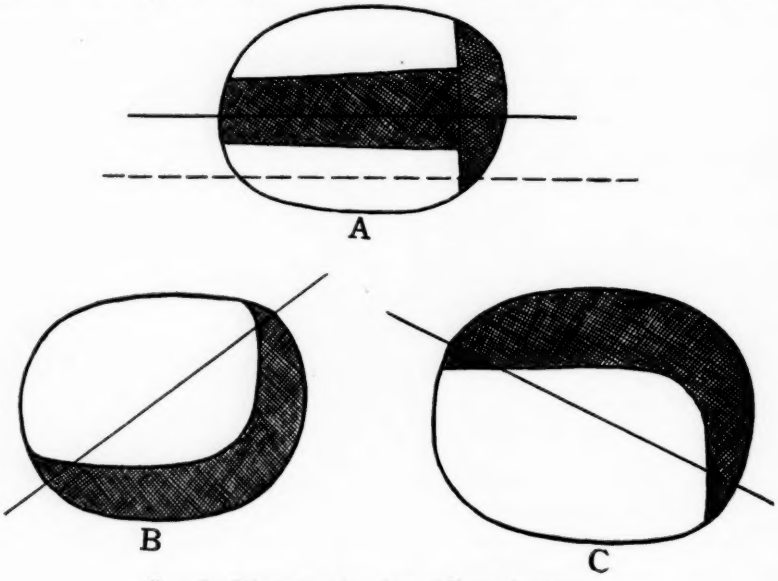


FIG. 6.—Diagram showing oblique fractures.

guess at the percentage, especially as our figures are complicated by many personal equations. At any rate, it may be argued that oblique fractures are far fewer than would be expected from a study of the mechanics of the region. Koffmann (*Deutsche med. Wochenschrift,* No. 43, p. 685, 1898) records a case of oblique fracture, and says that they are comparatively rare. He also quotes two cases of Baker, "Fractures of the Patella," and one of Tresonet (*Gazette des Hôp.,* Paris, No. 12, 1881). Powers, in the ANNALS OF SURGERY,

July, 1898, says that the usual direction of the obliquity is from above downward, outward, and inward, *i.e.*, the knee is fully flexed. From the St. Thomas's sources, I am inclined to agree with him. The insertion of the vastus internus into the upper and inner quadrant of the patella gives a slightly inward pull to the line of action of the resultant of the quadriceps, which will naturally lead to an obliquity of the fracture

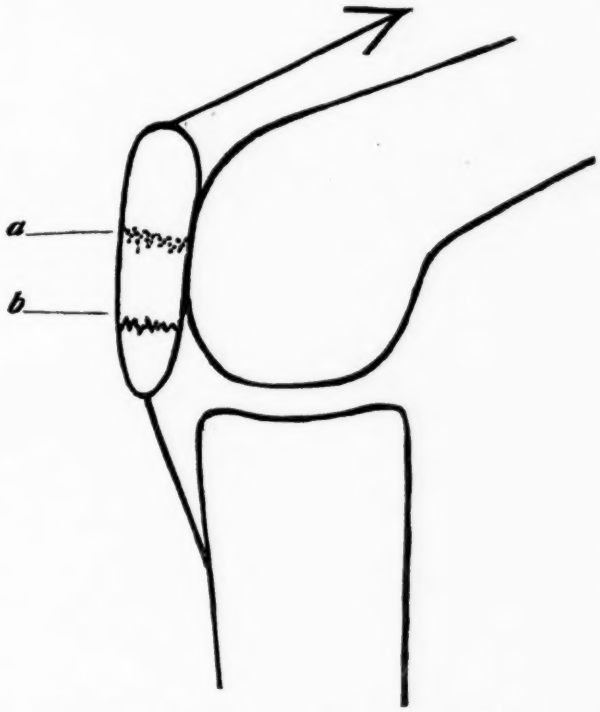


FIG. 7.—Diagram showing "contact" fracture, *a*, and non-contact, *b*.

line. This will be from above downward and without inward, agreeing with what Powers has said.

In the above, fracture at the point of contact alone has been considered. When a stick is broken across the knee, the fracture starts opposite the point of contact. In a few cases the patella fractures so low down that the break is extra-articular, "osseously" speaking, alone. These have obviously

been other than contact fractures, for the breach has occurred below the point of contact. Again, when the knee is only slightly flexed, the quadriceps has comparatively little mechanical advantage for fracture as it has when the knee is fully flexed. Hence, although by far the majority of the fractures occur during slight or semi-flexion, the muscles act relatively at a mechanical disadvantage. From consideration of the bony

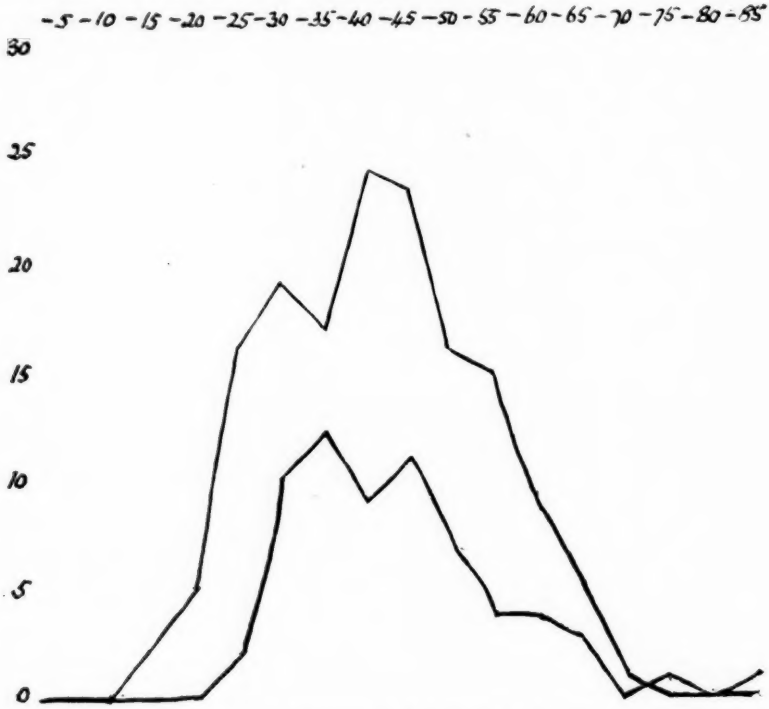


FIG. 8.—Age curves for fracture of the patella. Upper line represents male and lower line female.

structure, it was seen that the lower half of the patella was distinctly weaker than the upper; and it may be argued that the bone may give way at the weakest point which is not the contact-point. The direction of the line of such non-contact fractures will be transverse. In this way the comparative rarity of oblique fractures, or, better, markedly oblique fractures, may be explained. Such fractures are, on account of

the weakness of the lower end of the bone, far most likely to occur here. A similar fracture might occur close to the upper end of the bone, but this will be very rare.

In the course of my examinations of the St. Thomas's notes, I have noted certain facts which, though not perhaps of much value, are worthy of record and add to the completeness of this paper.

The total number of fractures admitted during the ten years was 272, and, according to the definition adopted, 254 were due to indirect violence and 18 due to direct violence. This gives the practical proportion of 14 to 1. Hamilton, for 127 (*i.e.*, half the cases from St. Thomas's cases), gives the proportion of approximately 7 to 1, or just half the proportion. In the cases I have used, I have examined the history of the accident, and have used my own judgment, so excluding as far as possible other personal equations. This is an infinitely higher proportion than is the case for the other leg bones which I also carefully worked out for the years 1892-1899 inclusively. For the femur the relation was 6.2 indirect to one direct, and for the leg bones 3.3 indirect to one direct. This extraordinary liability of the patella to suffer from indirect violence is obviously explained by the fact that it lies low on the condyles, over a functionally active joint, and must run great risks. The following shows the approximate frequency of direct and indirect fractures of the lower limb:

Patella, relation, 14 indirect to 1 direct. Femur, relation, 6.2 indirect to 1 direct. Leg bones, relation, 3.3 indirect to 1 direct.

Of the 254 cases of fracture by indirect violence, 198 occurred in males and 75 in females, giving the proportions of 2.7 males to one female, or in percentages 73 and 27. Professor Anderson (*loc. cit.*), from statistics gathered by Mr. Milton, states that fracture of the patella is relatively commoner in women than men as compared with other fractures of the leg. In consequence, observing the same precautions as regards indirect violence, I worked out the data. For the femur I obtained the result of 1.8 males to 1 female, or 64.2 per cent.

and 35.8 per cent., and for the leg bones 2.2 to 1, or 67.8 and 32.2 per cent.

Proportion of indirect violence fractures: Patella, male, 2.7; female, 1. Percentages, male, 75; female, 27.

Femur, male, 1.8; female, 1. Percentages, male, 64; female, 36.

Leg, male, 2.2; female, 1. Percentages, male, 68; female, 32.

This table shows that fractures of the patella are less common in females than males in a ratio greater than is the case with other fractures of the lower limb. They are really relatively most common in males for the patella and in females for the femur.

These figures are the more remarkable as, with Professor Anderson, no distinction was made between fractures due to direct and indirect violence, but all were added together, men suffering more from direct violence fractures than women.

With respect to age, the diagram (Fig. 8) shows curves corresponding to the number of cases occurring in each five years of life. The male curve starts between the years of 10 and 15 with two cases, and between 15 and 20 five cases. At the corresponding ages no cases occurred in females. From this point onward the male curve rises to a summit at 25 to 30, makes a small dip from 30 to 35, and reaches its maximum at 35 to 40, remaining nearly as high from 40 to 45. After this it steadily declines, reaching the base-line at 70 to 75, one case alone occurred after this from 80 to 85. The female curve, as has been mentioned, does not rise from the base-line until the ages of 20 to 25, when two cases occurred. It now rapidly rises to its maximum between the ages of 30 to 35 and to a second summit between 40 to 45, the base-line being regained at 65 to 70, after which one case occurred between the ages of 70 to 75.

It will be noticed that the male period of fracture precedes that of the female by a decade and lasts five years after that of the latter. Also that in the male the increase is more rapid,

and the first maximum attained five years before and the second five after the female. The oldest case occurred in a man some ten years older than the oldest woman.

A curve plotted from Hamilton's figures of both sexes (123 cases) begins at the same age as the male curve and rises extremely rapidly to a summit between the ages of 20 to 30 and then falls steadily and rapidly to the base-line. It differs from the St. Thomas's figures in the comparative variety of fractures from 35 to 45, which form the St. Thomas's maximum.

As a minor point, it may be mentioned that 58.2 per cent. occurred on the right side and 41.8 on the left. In only two out of 254 was the lesion bilateral, *i.e.*, about .8 per cent. Hamilton records no bilateral lesion, and, to show the futility of the "side" statistics, his are approximately 30 per cent. for the right and 70 per cent. for the left.

Refracture.—It is a matter of common knowledge that the patella is not infrequently refractured. During the period for which I examined the St. Thomas's records, I found, out of a total of 254 cases, 33 cases of refracture and 3 in which the patella of the opposite side had been previously broken. The latter cases are more rightly refractures in the individual. The figures give the percentage of 13.5 for refracture and 1.1 per cent. for fracture of the opposite bone. In speaking of refracture, I have confined my attention to cases which have resulted from indirect violence, and so far as is ascertainable also to the primary accident. Hamilton, among 127 cases, found 5 cases of previous fracture of the opposite patella, yielding an approximate percentage of 4, which is higher than the St. Thomas's. Comparing the percentage of refracture of the patella with that of the other leg bones for indirect violence, the result for the femur was found to be 1.6 per cent. and for the leg bones .7 per cent. The patella is then rebroken about nine times more frequently than the femur, and nineteen times more frequently than the leg bones. This liability to refracture is explained by its mechanical conditions, being situated over an actively functional joint, and also to two other conditions which have resulted from the adoption of the up-

right position, viz., an atrophic condition of the bone and its comparatively low situation on the femoral condyles due to the relatively short ligamentum patellæ. The conditions are naturally similar to those which have led to its original fracture. The question which naturally arises from this is, Does previous fracture leave any predisposition to refracture behind it? It is impossible to answer this directly, and consequently one is forced to a somewhat round-about method.

Osseous union as a result of the operation of wiring seems now to be held to give the best results, and this point has been most recently advocated by Powers after an examination of 711 cases (ANNALS OF SURGERY, July, 1898). In this process the best that can be hoped for is that the bone is returned to its normal shape and size; its strength somewhat doubtfully added to by the presence of the wire. As the fracture in the majority of instances (84 per cent.) lies about or below the centre of the bone, the wire connects a stronger and a weaker portion of the patella, and may occupy the insidious position of a piece of new cloth in an old garment. The above takes the view that the union is perfect and osseous. The next case to be considered is when short and strong fibrous union has occurred. In this case the length of the patella is increased, and in consequence there is greater liability to fracture across the femoral condyles. The fact that the fibrous union may allow of slight movement of the fragments on each other will, to a slight degree only, militate against this. In cases of larger fibrous union the movement of the fragments on each other is much increased, and therefore the liability to refracture may be less, but the additional danger of tearing of the fibrous union becomes greater. From *a priori* reasons it may be expected that refracture of the bone is most likely to occur after short fibrous or osseous union, whilst with progressive increase of the length of the union liability to refracture decreases and to rupture of the union increases.

In some cases osseous union seems to have occurred after a primitively fibrous union and left the patella much increased in length. Details of such cases are difficult to get, but Dr.

Henry (*American Journal of Medical Science*, 1899, p. 183) has fully recorded one. The first fracture occurred about the lower third of the bone, and was not wired; the second fracture occurred at the upper third. A skiagraph taken after the second fracture showed both fractures, the first apparently having united by fibrous and subsequently osseous union. The tilting of the lower fragment, as frequently occurs, happened in the first injury, and can be seen in the altered shape of the bone as indicated in the skiagraph. The length of the two fragments together measures three and one-quarter inches, and must have greatly conduced to the second injury, which occurred above the primary fracture and eight months afterwards.

Stumpf ("Inaugural Dissertation," Berlin, 1894), out of twenty-eight cases of fracture of the patella, came across nine cases of refracture, seven of which were bony and two in which the union had ruptured. As I have been unable to consult the original, details as to previous treatment could not be obtained. Bégonin and Anderodius (*Gaz. des Hôp.*, Paris, 1897) quote a number of cases by Ham, Brummen, and Lavise, besides their own, to show that refracture is commoner after treatment by massage than otherwise. This method usually yields short and strong fibrous union. Crickx, quoted by them, gives some very interesting figures; out of thirty-one cases treated by the Dutch method of massage he found 25 per cent. of refractures. Analyzing 249 cases treated by "other and older methods," a percentage of refracture of thirteen was obtained. As in other literature, it was not definitely stated whether the refracture was in the bone or the fibrous union. The most recent reference is that of Powers (*loc. cit.*), who states that a refracture is less frequent after wiring than after fibrous union. He gives references to the only cases of refracture that he could find, five in number. The percentages of refracture vary in the literature from 13 to 25 (St. Thomas's, 13.5). So far as can be ascertained, no attempt was made to separate fractures due to indirect from those due to direct violence.

From the St. Thomas's Hospital records details of thirty cases of refracture could be obtained. Of these eleven occurred after wiring and nineteen after other methods. Of the eleven that followed wiring, in five the situation of the refracture is stated, and in all it occurred at the same place as did the original injury. In three of these, which occurred ten days, twelve days, and two months after leaving hospital, it is specially stated that the wires were untwisted or drawn out. On the nineteen cases following fibrous union, in eleven the following details could be ascertained. In five the refracture was above the union, in two it was below, and in four it was through the same interval, *i.e.*, rupture of union. In secondary fractures after fibrous union, bony refractures are more common than rupture of the union, and occurs most commonly in the upper fragment. The latter point is easily understood, as the upper fragment is usually the larger, and with short fibrous union is far more likely to be broken, and hence, perhaps, the high rate of refracture obtained by Crickx after the Dutch or massage treatment. It may also be formulated that the lower the situation of the primary fracture the greater is the liability to a refracture. As the second fracture is more commonly above the primary, greater flexion of the knee must probably occur in the former than in the latter accident. It was impossible to make out the influence of the length of the fibrous union in these few cases, but it seems most likely, as has been suggested above, that the longer the union the less is the liability to refracture of the bone.

The time after the primary injury at which the secondary fracture occurred differs in cases submitted to wiring and other methods. To the St. Thomas's cases have been added those obtained from the literature that have occurred after wiring.

After wiring: Months, 1¼, 1½, 2, 2½, 3, 3, 3, 6, 6, 7, 8, 9,; years, 1, 1, 2, 3, 7.

After other methods: Months, 4, 4; years, 1, 1½, 2, 3½, 4, 4, 5, 6, 7, 11½, 18, 31.

After wiring, the second injury is most likely to happen

within the first few months or a year; in the other cases only after a year or more. After wiring, in the earliest two cases, the second injury was compound. These were the only two cases of compound refracture.

In the face of eleven cases of refracture occurring in the practice of one hospital within the space of a few years, Powers' statement of its rarity must be received as doubtful.

As the bone is not unfrequently refractured in the same individual, the following statistics are given showing these points:

Four times fractured in two cases; three times fractured in three cases; two times fractured in twenty-eight cases; one fracture of other patella, three cases.

It will be seen from the above that two fractures of the same bone are far the most common, and, through the smallness of the resulting fragments and the mobility resulting from the fibrous unions, further refractures are comparatively uncommon. No case in which wiring was performed presented itself with a third fracture. The fact that refracture of the same bone is more common than that of the opposite side indicates that some local predisposing condition results from the primary fracture. The patella had been also broken twice in two other cases admitted for recent fractures of femur and tibia and fibula respectively. Both were males, and are not included in the above list. Were they included, the percentage of refracture would rise to nearly 15.

Comminution resulting from indirect violence is obviously rare. One case occurred in which the lower fragment was split by an oblique fracture into two pieces.

As an uncommon cause of refracture may be quoted a case mentioned by Clutton (St. Thomas's Hospital Reports, 1895, p. 122). The cause which predisposed to the second fracture was adhesion of the patella to the femur as a result of the primary injury.

Of the thirty-six cases of refracture, thirty-two were of males and four of females, giving the proportion of 7.7 to 1, or 88.5 per cent. to 11.5 per cent. The corresponding figures for

primary fracture were 2.7 to 1, or 73 per cent. and 27 per cent. The proportion of males has increased in refracture, as might be expected.

The side affected can be of little importance. As the right is affected in primary fractures in the proportion of 58.2 per cent. to 41.8 per cent., in the left it would be expected that there would be a slight increase of the proportion of "rights" over that of "lefts." This is quite true, the actual figures being 60.7 per cent. and 39.3 per cent. respectively.

The age of refractures yields a very interesting curve in that its maxima occur just about five years after those of fracture, agreeing nicely with what has been said of the time of recurrence of refracture, *i.e.,* almost always within four years. By gauging proportions, it would seem that the younger the primary fracture occurs the more likely is a secondary fracture to occur, and that fractures occurring after fifty run a proportionately less liability to refracture. This certainly seems to suggest that vigor of body has to do with the case.

The ages of the four females were 20 to 25, 25 to 30, 35 to 40, and 45 to 50, in whom one refracture occurred.

In conclusion, I should like to make a suggestion as to the reason, or one of the reasons, of the failure of ossification to extend into even short fibrous unions. As the patella is a sesamoid bone, it differs from other bones in that it is not surrounded by a periosteum. In consequence of this, the osteogenetic powers must be comparatively small, and so bony union will not occur unless there is close approximation of the fragments.

SUPPURATIVE PERICARDITIS AND ITS SURGICAL TREATMENT, WITH AN ANALYSIS OF FIFTY-ONE CASES REPORTED IN LITERATURE.

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In a previous study of the subject,[1] I collected twenty-four published cases beginning with the first case of recovery, the case of Rosenstein, operated upon in 1881. Of this number eight recovered and sixteen died, and in one the result was unknown.

In one case pericarditis developed one month after a wound. Many of the cases were complicated with left empyema, and twice the pericarditis was discovered at operation while draining the empyema. Of the fatal cases, two died at operation; one lived two days; one (Delorme's case) lived eight weeks after the operation.

The organisms found in the exudate were the staphylococcus aureus and streptococcus pyogenes, pneumococcus, and colon bacillus (in case of stab wound).

The amount of pus evacuated varied from ten ounces to two quarts. In one (Dickinson's case), it was brownish and thin with arterial blood; in two (Körte's and Eiselsberg's cases), foul and thick; in two (Newman's and Delorme's), thin. In the majority it was thick, creamy, without odor. In a number of cases, large fibrinous masses were found, the

[1] Transactions of the American Surgical Association, 1897, Vol. xv, page 127.

pericardium being covered with thick layers of lymph. At autopsy in one fatal case (Pepper's), the whole sac was full of a thick mass of fibrin as large as the fist; the drainage had been good, and the heart probably failed from pressure of these fibrinous clots. The shortest case of healing of the sinus after drainage was nineteen days, the longest two months.

Preliminary aspiration was done in all these cases before opening the pericardium. In a number of cases paracentesis was done more than once, with and without injection of carbolic acid; and incision was finally resorted to owing to the rapidity of the reaccumulation. The immediate relief to pulse and respiration was almost always striking.

The Surgical Anatomy of the Pericardium.

All authorities agree as to the great variations in the line of reflection of the pleura and pericardium.

Sick found that in the adult, out of twenty-three cases, the pleural reflection at the level of the fifth rib cartilage lay either at or within the left border of the sternum in seventeen; at the level of the sixth cartilage the pleural border had not gone beyond the sternal border in ten; at the level of the sternal articulation of the seventh cartilage it was in nine cases at the sternal border, or this cartilage was below its lower border. Twice it was less than one centimetre from the sternal border.

In twelve children, Sick found that, at the level of the fifth rib cartilage, the pleura was either within or just at the sternal border in eleven. At the level of the sixth cartilage the pleura had not left the sternal border eight times.

It will thus be seen that, according to Sick's careful observations, even at the fifth space the reflection of the pleura will often be behind the sternal border. Brooks (quoted by Quain), in four out of seven quite healthy cases, found the left pleural reflection entirely behind the sternum, and in one at the sternal border.

According to Luschka (quoted by Quain), the pleura

normally diverges from the median line at the upper border of the fifth costal cartilage, so that at the level of the fifth cartilage it is one-fifth centimetre, at the sixth, two centimetres, and at the seventh, 3.5 centimetres, external to the left border of the sternum.

Delorme and Mignon found in thirty-two adults that in the fourth interspace the left pleural border was within the border of the sternum in seventeen. At the level of the fifth cartilage it lay fifteen times internal to the sternal border and seventeen times outside. In twelve cases at the fifth interspace the pleural border was at, or inside, the sternal; and in the sixth space the pleural border was outside the sternum in twenty-six cases, and at or within it in eight.

Dr. Thomas Dwight, Professor of Anatomy at Harvard University, agrees in the main with Sick's observations, but states that there are many variations, and that frequently it is possible to reach the pericardium through the fifth intercostal space and frequently not. Owing to the fact that the sixth intercostal space is small and narrow, and that even here the pleura often reaches the sternal border, he concurs with the writer in advising resection of the fifth costal cartilage, and if necessary the excision of a piece of the sternum opposite this cartilage.

The internal mammary artery, according to Quain, runs parallel to the sternum at a distance from it of one centimetre. Delorme and Mignon, in thirty cases, found it a distance from the sternum of from one-half to two centimetres, the distance averaging about the same in the first six interspaces.

In looking over the arrangement of the left pleura by Dwight, Delorme, Sick, Quain, and Testut, all agree that there is a varied arrangement. Below the fourth intercostal space in the majority there is a slight interspace close to the border of the sternum which is free from pleura. In twenty-two operations on the cadaver by myself it was found that the removal of the fifth intercostal cartilage, and the removal of half an inch of the sternum opposite the sternocostal joint,

gave free access to the normal pericardium near its lowest level.

Three of the methods of operation which have been proposed and practised, namely, trephining the sternum (Riolan), approach through an intercostal space, and epigastric incision (Larrey), should all be discarded, as it will be evident from the above account of the anatomy that in all of them there is danger of wounding the pleura or diaphragm.

In this earlier work I decided that operation was indicated in all cases of purulent pericarditis, and perhaps in serous pericarditis in cases where aspiration, once or twice repeated, is followed by reaccumulation of the fluid; and the following "ideal operation" was planned after careful consideration and experiment on the cadaver in order so far as possible to meet the following indications:

(1) To avoid opening the pleural cavity. This may be made more easy by adhesions as a result of tapping or inflammation.

(2) To open the pericardium opposite the point where drainage will remain good after the sac has contracted.

(3) To secure permanent and free drainage.

The steps of the operation are

(1) An incision from the middle of the sternum outward over the fifth costal cartilage to its junction with the rib.

The soft parts are cleaned from the cartilage with periosteum elevator, care being taken not to wound the pleura on the under surface. The cartilage is divided with bone forceps from the rib and the sternum. The internal mammary artery and vein are thus exposed, ligated in two places, and divided between. The triangularis sterni is separated from the sternum and pushed to the right.

A little careful dissection with the director in case fat is encountered exposes the pericardium, which is normally much thicker than the pleura. An aspirating needle should now be introduced, if this has not been previously done, in order to corroborate the diagnosis. If confirmed, the knife should follow the needle. The incision in the pericardium is

best made obliquely downward and outward, beginning close to the excised border of the sternum. The edges of the pericardium should be stitched to the soft parts.

Irrigation should always be employed, with the object of removing any masses of fibrin which may lie at the bottom of the cavity; and if there are many such masses, it should be continued until the fluid returns clear.[1] The fluid may be weak sublimate or carbolic solution, or salt solution, according to the preference of the operator. The fluid must be warm, and must have free exit.[2] With this exception no harm has resulted from irrigation, which has been practised in more than half the cases.

Drainage is best provided by two rubber tubes, one long and reaching to the bottom of the sac for the inflow, and a short tube just entering the sac for the outflow. As the discharge diminishes, one tube may be removed, and finally gauze drainage inserted. Gauze drainage has proved adequate from the first, but where the fluid is thick or flocculent, tubes give the only adequate facilities for the subsequent daily irrigation.

The after-treatment must, of course, be directed to two ends: first, systemic treatment, consisting of forced feeding and free stimulation, and second, the care of the wound and the maintenance of drainage. The wound should be irrigated daily, and the patient, if his strength is sufficient to allow it, turned on his stomach to afford drainage.

Roberts, of Philadelphia, also, before the meeting of the American Surgical Association in 1897, presented an elaborate and exhaustive review of this subject. In this report he advocates the method of turning up a flap consisting of portions of the fourth and fifth left costal cartilages with the attached soft parts, thus exposing the field of operation. This method he had never followed on the living subject. Roberts collected

[1] Delorme's case, in which at autopsy two handfuls of fibrin were found in the pericardium.

[2] Parker's case; death on table from distention of sac by irrigating fluid.

thirty-five cases from all literature up to June, 1897, including my own case.

The previous work of the writer and the careful paper by Roberts brought the collected knowledge of this subject up to the summer of 1897, and leave us nothing further to do than search the work of the last three years, and make our final conclusions and analyses.

Voinitsch-Sianojewsky, of St. Petersburg, in 1897 (*Annales de Chirurg.,* Russe, 1897, xiii, ii, f. 3; also *Revue de Chirurgie,* 1898, Vol. xviii, p. 993) contributed a long study on the anatomical questions in pericardotomy, but added nothing new to the conclusions of Delorme and Mignon or to the anatomical studies of the writer given above. He refers to a case of incision in the second intercostal space for suppuration in the pericardium done by Bexman, of Russia, in 1891, with recovery. This case is not mentioned so far as known elsewhere. He refers to a number of different methods of incision, and the advocates of each as known to him.

(Through the third intercostal space,—Sievens.

Through the cartilage of the fourth rib,—Eiselsberg.

Through the fourth space,—Rosenstein, Orlow, Minine, Bronner, Parker, Klefberg.

Through fifth rib cartilage,—Ollier, Gussenbauer, and Körte.

Through fifth space,—West and Davidson.

Desault and Robinson, as well as he himself, advise operation through the sixth rib and sixth space.

Del Vecchio resects fourth and fifth ribs and cartilage, also Roberts.

Delorme and Mignon the fifth and sixth, Riolan, Laennec, Skielderup, and P. Malle propose to trephine the sternum in the median line.

Velpeau, Pirogoff, Baizeau, Delorme, and Mignon think it unnecessary to keep to left side of the sternum, while Desault, Romero, Karanaeff, Trousseau, and Tillaux advise it. Rotch, Wilson, and Dickinson chose fifth space on right side for tapping.)

He claims to have had the opportunity of studying post-mortem twenty cases of pericardial effusion, and to have done 100 pericardial operations on the dead; and on this experience he declares that incision through the sixth costal cartilage will *always* avoid the pleura (which is not an accurate statement), and his proposed method of operation is to go through the sixth cartilage and, if necessary, cut away some of the seventh cartilage also.

He states that open incision in all cases of pericardial effusion (not only in purulent cases) should be much preferred to puncture, because of the danger of wounding the heart and pleura by any method of using a needle.

Eichel, in 1899 (Die Schussverletzungen des Herzbeutels, *Archiv f. klin. Chir.,* Band lix, Heft 1, 1899; also ANNALS OF SURGERY, Vol. xxx, p. 658, 1899), gives a fairly complete *résumé* of the anatomy of the pericardium and pleuræ with several diagrams. This article is chiefly valuable as showing that the most modern anatomical work does not change the accepted views of 1897 as given by me. In his paper he makes reference to all the latest foreign works upon anatomy. (Lehrbuch der Topographische Chirurg. Anatomie von Joessel und Waldeyer, Bonn, 1899; also Ferrier et Reymond, "Surgery of Heart and Pericardium," Paris, 1898.)

He recommends pericardotomy for all effusions as well as for all wounds. He gives several interesting cases of operation for wounds and the resulting hæmorrhage into the pericardium.

The use of tubes for drainage after hæmo- or pyopericardium operations Eichel opposes; stating that he had a case in which he could not keep the ends of the tubes from impinging on the heart wall and causing stormy and irregular action. He says that Riedel had a case that taught him the same thing (refer to Riedel, *Verhand. der Deutsche Gesellschaft für Chir.,* 26th Cong., 1897, S. 72; also *Centralblatt f. Chir.,* 1897, p. 56).

A point which is of great importance, and which Brentano and Schaposchnikoff lay great stress upon,—viz., the anterior

situation of the heart in all effusions into the pericardium, is denied by Eichel. In his cases, he says, there was plenty of fluid between the heart wall and the anterior wall of the pericardium.

Brentano (*Deutsche med. Wochenschrift,* 1898, xxxii, p. 506) reports five cases of operation for pericarditis, and discusses this question as to the situation of the heart when the pericardium is more or less full of fluid, whether it is nearer to the posterior than the anterior wall. From his clinical experience, Brentano decides that in all pericardial effusions the heart is situated down and forward, and most often lies right against the anterior wall of the sac even when no adhesions exist, and that in many cases there will be adhesions between the pericardium and the anterior wall of the heart. In all cases most of the pericardial fluid is behind. If this anterior situation of the heart is a fact, the danger of wounding the heart wall in all cases of paracentesis is great.

Brentano advises open incision in any effusion, with resection of the fifth costal cartilage. In fact, this seems to be the growing thought in the last few years,—that incision through a resection of the fifth left costal cartilage is a far safer operation than paracentesis.

Schaposchnikoff, in 1898 (*Russisch. Archiv f. Pathologie klin. Med. und Bacteriologie von Padw.,* July, 1896; also *Deutsche med. Wochenschrift,* 1898, No. 38, p. 611), agrees entirely with Brentano on this question. He states that he has studied the point for twenty-seven years clinically, post-mortem, and experimentally, and has proved that the heart is in all cases forward against the sac wall.

Brentano recommends almost the identical procedures of my own technique, viz., stitching of the sac to the skin, and irrigation; for drainage, however, he always used iodoform gauze, not tubes.

He decides that opening the pericardium through a resection of fifth rib cartilage is very simple, and advises against puncture in any case. Local anæsthesia with cocaine is all that is needed in most cases. In regard to this question,

Körte, speaking at the Freie Vereinigung des Chirurg. at Berlin, December 13, 1897 (*Deutsche med. Wochenschrift,* 1898, p. 170), favored the use of cocaine in many cases, but stated that, in certain cases of thick chest walls, ether or chloroform must be used. Brentano mentions as one of his chief arguments against puncture in cases of serous effusion that it is impossible to remove anywhere near all of the fluid by aspiration alone. Of eighty cases of paracentesis tabulated by West, in twenty-three the puncture had to be repeated.

Brentano reports five cases, which are as follows: All five were done by resecting the fifth rib cartilage; two were for purulent pericarditis following acute osteomyelitis in children seven years old. Operation was followed by temporary and marked improvement, but death occurred in twelve days from pyæmia, as shown by autopsy.

In both cases there were found multiple abscesses in the heart muscle itself, and in one the direct cause of death was from rupture of one of these abscesses into the left ventricle.

Two cases were for subacute serofibrinous pericarditis after rheumatic attacks and rheumatic endocarditis. Both died in three days.

The fifth was a brilliant case of open incision for simple serous pericarditis, without preliminary puncture.

These cases are given in full in the list of cases appended to this paper.

Delorme, in 1898 (*Gazette des Hôpitaux,* 1898, p. 1150), the same surgeon who collaborated with Mignon in 1895 in an article on the technique of pericardotomy (*Revue de Chir.,* September and October, 1895), recommends resection of the fifth rib cartilage to relieve mediastinal and pericardial adhesions whether or not due to tuberculosis, and also as the route to the pericardium in all cases.

H. Allingham (*Lancet,* March 10, 1900) brings forward an entirely new method of operation for draining the pericardium in suppurative cases, and also, with Ogle, of London, reports a case of purulent pericarditis operated on, though not by his suggested method. The case was one of purulent

pericarditis originating from a chronic abscess in the pleural cavity near the pericardium. Incision after resecting the fifth cartilage was followed by death in fourteen hours.

(This case is given in my list of cases.)

Allingham's suggested method, which he has tried on twelve cadavers but never on the living, is as follows: It is designed to give best access to the sac and best dependent drainage by opening the sac from below through the diaphragm.

I. An incision about three inches long, with its upper end at the costoxiphoid angle, is made along the lower edge

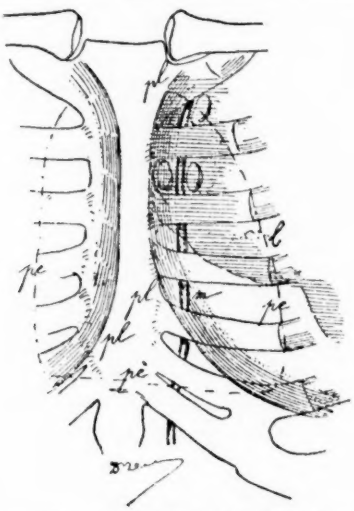


FIG. 1.—Normal contour of pleura and pericardium (Delorme and Mignon). *Pl*, pleura; *pe*, pericardium; *l*, border of lung.

of the seventh costal cartilage; the latter is then exposed by separating the abdominal muscles from it; the cartilage can then be pulled up and back, exposing the fibres of the diaphragm together with the cellular interval between its attachments to the cartilage and to the xiphoid appendix.

II. This cellular space is enlarged by cutting or tearing through the muscle of the diaphragm as far as necessary, when a mass of fat is usually seen just above the diaphragm in the space between the diaphragm below, the sternum in front, the

pericardium above and behind. This fat, together with the diaphragm, is then pulled down when the pericardium presents, and can be opened up at its lowest point.

During the operation the peritoneum may be exposed to a slight extent as it sweeps downward from the under surface of the diaphragm. It is, of course, not injured, being pushed away as in a suprapubic cystotomy.

The advantages claimed for this method are as follows:

I. The pleural cavity cannot be injured, as it is far away

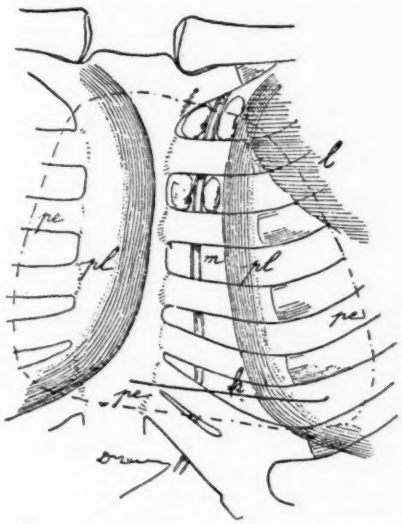


FIG. 2.—Line of pleura, abnormally to left of sternum (Delorme and Mignon). *Pl*, pleura; *pe*, pericardium; *l*, border of lung; *h*, base of heart.

in the normal arrangement of the organs and farther off in pericardial distention. It is claimed that this is the only sure method of avoiding the pleura.

II. Drainage is through the most dependent part of the sac, through a large opening not limited by bone or cartilage.

III. Great ease of exploration and cleaning of the sac is afforded.

In certain fat subjects it may be necessary to cut away some of the seventh cartilage to get room in the xiphoid

space. (It is to be noted that Roberts has recommended this area as the point of election for puncture, though not for incision.)

Ljunggren (*Nord. Med. Ark.*, New Series, 1899, Vol. ix, No. 28, in a paper extracted briefly in ANNALS OF SURGERY, 1899, Vol. xxx, p. 659) reports a case of suppurative pericarditis successfully treated by incision and drainage. (The full details of the case will be given in the list of cases.)

He objects to puncture as a dangerous procedure in any case, recommending incision and drainage as the rational thing

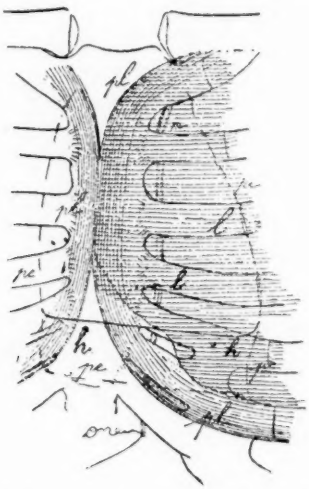


FIG. 3.—Left pleura, behind sternum, reaching beyond middle line (Delorme and Mignon). *Pl*, pleura; *pe*, pericardium; *l*, border of lung; *h*, base of heart.

in all cases. He added six cases to Roberts's thirty-five, making forty-one in all; but four cases are inaccessible to us and doubtful. Of these, sixteen recovered and twenty-five died. Of the sixteen recoveries, eight were complicated by other diseases; in seven of the fatal cases death was due either to faulty methods or slowness in operating.

His eight rules for the technique of the operation do not differ from my published method. He uses rubber drainage-tubes double.

The pleura should be loosened with blunt dissector and sutured laterally to prevent infection of the pleural cavity. He mentions the occasional necessity of cutting away some of the sixth cartilage, after resecting the fifth, in order to get more room, but does not mention removing any of the sternum. General anæsthesia is not necessary, and in weak cases is contraindicated.

Lilienthal, of New York, in 1899 (*Journal of the American Medical Association,* 1899, Vol. xxxiii, p. 1422; also *Medical News,* November 23, 1899), reports a case of recovery from operation in a boy convalescing from lobar pneumonia; operation under eucaine local anæsthesia, forty ounces pus evacuated, giving cultures of pneumococci; this organism and streptococci were also in the sputum. (Details of this case are given in the list of cases.)

C. Mansell-Moulin, in 1897 (Transactions of the Clinical Society, 1897, Vol. xxx, p. 217), reports an operation for "hæmopericardium," as he calls it. The case was successfully operated on about one month after a blow on the chest at football, and six pints of thin, dark, bloody fluid removed, from which no cultures were made. It seems reasonable to class this with purulent cases as certain other cases of suppurative effusion after injury (note the case of Riedel, also case of West). (The case is not very dissimilar from Eiselsberg's at the first aspiration.)

Sevestre, in 1898 (*Lancet,* April 23, 1898), reports a case of purulent pericarditis in the course of acute pneumonia. Cultures, pure pneumococcus. Operated on under cocaine anæsthesia. Double empyema afterwards with resection of ribs on each side. Death. (See list of cases.)

In Sevestre's case, two aspirations were attempted before the incision was finally resorted to. At the second aspiration only bright blood was obtained (the query arises as to whether the heart itself was wounded). The operation through the fourth space seems to have been careless, and the empyema following may have been caused by the pericardial operation.

H. Betham Robinson, who reported his first case in Transactions of the Clinical Society, Vol. xxx, has reported a second case in 1898 (*British Medical Journal,* November 26, 1898, Vol. ii, p. 1605). A case following bronchopneumonia in a child four years old. Death in three days. (See list of cases.)

Several recent elaborate papers given in the bibliography deal with surgery of the heart itself or with the surgery of wounds of the pericardium.

Loison, on wounds of the heart and pericardium, an exhaustive paper in *Revue de Chirurgie,* 1899, Vol. xix, gives in his table four cases of pericardotomy for wounds of pericardium, viz., cases of Cappelen, Eiselsberg, Garber, and Riedel. Two of these, Eiselsberg's and Garber's cases, are cases of operation for suppuration following wounds.

A new method of opening the chest in surgery of the heart and pericardium is advanced by Wehr. (*Archiv f. klin. Chirurgie,* Band lix, p. 949.) He recommends it especially where large exposure is necessary in wounds of the heart itself. It consists of making an elliptical flap of skin, bone, and cartilage, cutting across sternum at base of fourth cartilage, and again at xiphoid joint, and by curving sweep take in fourth, fifth, sixth, and seventh costal cartilage, turning this flap back with the right edge of the sternum as a hinge. He does not say he has done this on the living.

Manges, of New York, in 1900, reported on cases of pericarditis following pneumonia at the Mt. Sinai Hospital (*Medical News,* January 20, 1900). In 500 cases, pericarditis developed in only eleven, and of the eleven, five died. He thinks all cases of pericarditis as a complication of pneumonia are due to the pneumococcus, and further states that infection with this organism is probably in many cases of so-called idiopathic pericarditis. This same organism finds its way from the pulmonary passages. In the pericardium, as in the meninges, the pneumococcus is always a pyogenic organism. It is probable, he says, that many cases of pericarditis in pneumonia are overlooked because the conditions around the heart, when the left lung is affected, are such as to obscure the most important

sign, viz., increase of heart dulness; the to-and-fro murmur of the pericardial friction may last but a few hours.

Connor and Stimson, of New York, in 1900 (*Medical News,* January 20, 1900), report a case of purulent pericarditis after a severe pneumonia. Operation under local anæsthesia by Dr. Stimson. The right pleura was cut accidentally; death in a few days from purulent pneumonia.

Ljunggren, in his paper (*loc. cit.*), after reporting his case, the history of which has been translated and put in my list of cases, goes on to say that he has found some new cases which are not in previous lists. Three of these cases are inaccessible, however, and are given thus by him with no details, he merely giving the references.

(Hirschsprung cited by Heyde. Heyde in a Dissertation auf Kiel, 1896. Perls in a Dissertation auf Strassburg, 1896.)

The other cases are those of Brentano, which I have given.

It has been possible for the writer to add fourteen cases to the former collections of my own and Roberts, without counting the above three cases cited by Ljunggren, the details of which are not to be had. These make a total of fifty-one cases. Of this series of cases the annexed tabular view has been made.

An analysis of the fifty-one cases gives the following facts:

Forty-six were for purulent pericarditis, septic; two were for serofibrinous pericarditis, rheumatic; one was for hæmorrhagic pericarditis, traumatic; two were for serous pericarditis.

The etiology is as follows:

Pneumonia with and without empyema	14
Bronchopneumonia (in a child)	1
Osteomyelitis	5
Wounds, gunshot or stab	4
Blow on chest	1
Periostitis	1
Necrosis of nasal bones	1
Septic throat	1
Septic arthritis of knee	1
Abscess of buttock	1

Empyema without pneumonia	5
Pleurisy of doubtful origin	2
Pleurisy with typhoid fever	1
Pleurisy with bronchitis	1
Influenza	1
Tuberculosis(?)	2
Unknown origin	7
Rheumatic fever and endocarditis more or less acute	3

Of the total fifty-one cases of incision for pericarditis, twenty recovered and thirty-one died,—a mortality for all cases of 60.5 per cent.

Of the two operations for simple serous pericarditis both recovered.

Of the fourteen cases in which acute pneumonia, either lobar, bronchial, or septic, was the cause of the purulent pericarditis, only four recovered (cases of Bohm, Lilienthal, Porter, and Bjorkmann); in two of these the pneumococcus was cultivated from the pus. The other two report no bacteriological studies.

Twenty cases were not tapped previous to operation. Local anæsthesia with cocaine or eucaine was used in six cases.

Conclusions.

(1) Pericardotomy is indicated in all cases of suppurative pericarditis.

(2) Because of the uncertain and varying relations of the pleura, and because of the anterior position of the heart whenever the pericardial sac is distended by fluid, aspiration of the pericardium is a more dangerous procedure than open incision when done by skilled hands.

(3) Incisions of the pericardium can be done quickly and safely by resection of the fifth costal cartilage, and in many cases under local anæsthesia.

(4) In many cases of serous effusion, open incision without puncture will offer less risk and speedier cure than aspiration.

(5) The method and detailed technique of the writer pro-

posed in 1897 have been followed out by the majority of recent operators.

CASES OF SUPPURATIVE PERICARDITIS TREATED BY INCISION.

CASE I.—(Hilsmann, "Ueber die Paracentese des Pericardiums," Kiel, 1875, Inaug. Dissert.) Date of operation, 1844. Male, aged twenty-five years. Ill eight months. No complications. Not tapped previously. Incision fourth interspace, a finger's breadth from left edge of sternum. Four tumblerfuls of pus evacuated; much more escaped within a few hours after operation. No irrigation of pericardium. Permanent drainage, wound kept open by inserting probe. After-treatment, nearly three months. Recovered. The pericardium was opened behind the sternum, though the external wound was a short distance to left of sternum. As the sac was gradually drained, its walls contracted and the pericardial opening moved to the left. In a few days the opening was one and one-half inches to left of sternum and over the fourth rib. In order to empty the sac thoroughly when the external wound was dressed, the patient had to bend over as if he was about to stand on his head.

CASE II.—(Langenbeck, *Vorlesungen über Chirurgie,* Berlin, 1888, p. 449.) Date of operation, 1850. Gunshot wound and necrosis of ribs. Not tapped previously. Incision where fifth rib was destroyed. No irrigation. Recovered. Patient had been wounded in a duel in which the bullet shattered five ribs. Necrosis had subsequently occurred, and purulent pericarditis resulted.

CASE III.—(Rosenstein, *Berlin. klin. Wochenschrift,* January 31, 1881, p. 62.) Date of operation, 1879. Male, aged ten years. Ill twenty-eight days. Pleuritis a complication. Tapped twice a few days previously with aspirator; pleura also tapped. Incision fourth interspace near sternum. Great quantity of pus evacuated. No irrigation. Permanent drainage with two drainage-tubes. After-treatment, about two months. Recovered. Pleuritis apparently occurred after tapping and incision of pericardium.

CASE IV.—(West, *Medico-Chirurgical Transactions,* 1883, p. 235.) Date of operation, 1882. Male, aged sixteen years. Ill one month. No complication. Tapped three days previously. Incision, fifth interspace, in line of left nipple. Two quarts of pus evacuated. Irrigation, carbolic acid solution, 1 to 40. Permanent drainage with drainage-tube. After-treatment, five months. Recovered. Rod-shaped bacteria found in pus. Patient in good health nine years afterwards. West believes that pericardial adhesions had occurred, but there was no evidence of this condition.

CASE V.—(Partzevsky, *London Medical Record,* February 15, 1883, p. 33.) Date of operation, 1882(?). Male, aged twenty-three years. Ill thirteen weeks. Pleuritis a complication. Tapped twice. Incision, fourth interspace. Irrigation, salicylic acid solution. Permanent drainage with drainage-tube. After-treatment, thirty hours. Death. Autopsy showed cardiac hypertrophy with fatty degeneration, pleural adhesions, and pulmonary œdema.

CASE VI.—(West, *British Medical Journal,* December 8, 1883, p. 1129, and February 21, 1891, p. 404.) Date of operation, 1883. Male, aged fourteen years. Pleuritis, pneumonia, abscess of thigh, arthritis were complications. Pericardium opened with bistoury, from wound made to evacuate a supposed pleural effusion. Twenty-four fluidounces of pus evacuated. After-treatment, fourteen days. Death. At autopsy found extensive pericardial adhesions.

CASE VII.—(Savory(?), reported by Brinton and Collyns, *St. Bartholomew's Hospital Reports,* 1883, Vol. xix, p. 271.) Date of operation, 1883. Male, aged nine years. Ill seven weeks. Abscess of shoulder and thigh, pleuritis and pneumonia as complications. Serum obtained from pleura at two previous tappings. Incision, fifth interspace in anterior line of axilla through pleural cavity, which was opened because effusion believed to be pleural. Twenty-four fluidounces of pus evacuated. Irrigation, Condy's fluid. Permanent drainage with drainage-tube. After-treatment, fifteen days. Death. Case was one of pyæmia. Autopsy showed no communication between left pleura and the track leading through it to pericardium, because adhesions had occurred.

CASE VIII.—(Scott, *New Zealand Medical Journal,* July, 1891, p. 268.) Date of operation, 1883. Male, aged six years. Ill five weeks. No complication. Tapped with trocar one day previously; irrigation with carbolic acid solution, 1 per cent. Permanent drainage; two openings an inch apart, with drainage-tube through both. Recovered.

CASE IX.—(Newman (or Sterling), *Australian Medical Journal,* July 15, 1885, p. 303.) Date of operation, 1885. Male, aged thirty-two years. Ill two months. Typhoid fever and pleuritis were complications. Aspiration, five times; fifth time silver canula allowed to remain for drainage; at fifth tapping, carbolic acid solution and tincture of iodine solution used for irrigation; first aspiration one month previously. Incision, third left interspace; incision made where fistula existed from canula, which had been draining the sac for three days. One hundred and seventy-four fluidounces of pus had been evacuated by five previous tappings. Irrigation with tincture of iodine. (British Pharmacopœia, 1-10.) Permanent drainage with rubber tube. After-treatment, five days. Death. First aspiration was done in sixth left interspace; second, in fourth right interspace; in third and fourth aspirations no information as to point is given; fifth tapping done in third left interspace. At autopsy a sinus found in second interspace leading from pericardium to the subcutaneous tissue.

CASE X.—(Mikhailov, *Med. Oboz.,* Moscow, 1885, Vol. xxiii, p. 475; ANNALS OF SURGERY, November, 1885, quoted from *London Medical Record,* August 15, 1885.) Date of operation, 1885(?). Female, aged thirty-five years. Ill about three weeks. Pleural, bronchial, and renal lesions as complications. Tapped two days previously. Incision, fourth interspace, near sternum. Two fluidpounds(?) of pus evacuated. Irrigation with boric acid solution. Permanent drainage with drainage-tube. After-treatment, eighteen hours. Death. Autopsy showed cardiac dilatation with fatty degeneration, pleural and bronchial disease and kidney

lesions. Bacteriological examinations of heart and pericardium were negative.

CASE XI.—(Gussenbauer, *Wiener med. Wochenschrift,* November 22, 1884, p. 1403.) Date of operation, 1885(?). Male, aged thirteen years. Acute osteomyelitis of left shoulder as complication. Incision, fifth rib resected, pericardium opened through pleural cavity because effusion was supposed to be pleural. Irrigation with thymol solution. Permanent drainage by stitching pericardium to edges of wound. Recovered. Small fistula remained when case was reported.

CASE XII.—(Rouse (Dickenson's patient), *Transactions of the Clinical Society,* London, 1889, p. 48.) Date of operation, 1887. Male, aged ten years. Ill about fifteen weeks. Gluteal abscess, pleuritis, abscess of finger as complications. Pleura tapped twelve times; serum obtained. Tapped pericardium three times; last time one week previously. Incision, fifth interspace, right side, close to sternum. No irrigation. Permanent drainage with drainage-tube. After-treatment, two and one-half months. Recovered. Case considered one of pyæmia. Patient lay on face at times to encourage drainage.

CASE XIII.—(Underhill, *Edinburgh Hospital Reports,* 1896, iv, p. 200.) Date of operation, 1887. Female, aged six years. Ill two days. Pyæmia; had periosteal abscess of tibia a few weeks previously; autopsy showed abscesses in kidneys and pleura. Aspirated twice, last time five days before incision. Incision, fifth left interspace, close to border of sternum. Over ten fluidounces of pus evacuated. No irrigation. Permanent drainage with drainage-tube. After-treatment, five days. Death. Several hæmorrhages from interior of pericardium. Autopsy showed that the bleeding probably came from granulation-tissue on inner surface of pericardium, probably the seat of septic emboli.

CASE XIV.—(Parker, *Transactions of the Clinical Society,* London, 1889, Vol. xxii, p. 60.) Date of operation, 1888. Female, aged nine years. Ill six and one-half weeks. Osteomyelitis of tibia and suppurative arthritis of knee as complication. Tapped four days previously. Incision, fourth interspace along left border of sternum, with resection of one inch of fifth costal cartilage. A large quantity of pus and lymph evacuated. Irrigated. Permanent drainage, pericardium stitched to edges of wound. Death occurred during irrigation, immediately after incision. Pus did not flow well; it was thick, and contained membraniform shreds; hence irrigation was adopted. Operator believed death was caused by irrigating fluid collecting in the pericardium, as the opening in the pericardium became plugged with lymph. Pressure on heart proved fatal. Patient was pyæmic. No special lesion found in chest at autopsy, except pericardial changes.

CASE XV.—(Halsted, *University Medical Magazine,* Vol. vi, p. 248.) Date of operation, 1890. Male, aged thirty-six years. Ill over three weeks. Acute necrosis of bones of nose, albuminuria, and congestion of right lung as complications. Not tapped previously. Incision, fourth interspace midway between nipple and sternum. Over a quart of pus evacuated. No irrigation. Permanent drainage with gauze plug. After-treat-

ment, seventeen days. Death. Great improvement after operation. Dr. Osler, who reports case, calls the pericarditis septic, and attributes the fatal result to a probable myocarditis. No autopsy was made.

CASE XVI.—(Delorme, *Revue de Chirurgie*, 1895, Vol. xv, p. 1008.) Date of operation, 1890. Male. Ill eighteen days. Double pleuritis as complication. Empyema operation. Not tapped previously. Incision, fourth interspace, a little outside of internal mammary vessels. A few drops of pus evacuated. No irrigation. After-treatment, a few moments. Death. Patient died of asphyxia, which had caused the pericardial operation to be hurriedly undertaken. Autopsy showed front of heart adherent to pericardium, and about 500 grammes of seropus collected at the base and sides of the heart, and a great quantity of false membranes that could only have been removed by a large opening, followed by washing and direct extraction. The opening in the fourth space was over the adherent region.

CASE XVII.—(Davidson, *British Medical Journal*, March 14, 1891, p. 578.) Date of operation, 1890. Male, aged six years. Ill over four weeks. Metatarsal necrosis, subperiosteal abscess at eighth rib on right side; empyema, pneumonia as complications. Not tapped previously. Incision, at fifth interspace. Eight fluidounces evacuated. No irrigation. Permanent drainage with drainage-tube. After-treatment, seven days. Death. Autopsy showed no pericardial adhesions; pneumonia. Case was considered septic.

CASE XVIII.—(Davidson, *British Medical Journal*, March 14, 1891, p. 578.) Date of operation, 1890. Male, aged six and three-fourths years. Ill nearly four weeks. Empyema as complication which had been operated upon. Pericardium not tapped. Incision, fourth interspace, one inch from left edge of sternum. Several fluidounces of pus evacuated. No irrigation. Permanent drainage with draining-tube. After-treatment, over seven weeks. Recovered.

CASE XIX.—(Teale (Bronner's patient), *British Medical Journal*, February 14, 1891, p. 350.) Date of operation, 1890. Female, aged eleven years. Ill thirty-four days. Influenza, pneumonia, empyema as complications. Empyema operated on previously. Incision, without aspiration, through fourth interspace one inch from left border of sternum. Nearly two pints of pus evacuated. Irrigation, iodoform and glycerin, solution of boric acid and carbolic acid. Permanent drainage with drainage-tube. After-treatment, twenty-six days. Death. No autopsy made, but a probe passed into pericardium discovered no adhesions, though soft granulations were felt towards base of heart.

CASE XX.—(Deaver, *University Medical Magazine*, 1894, Vol. vi, p. 297.) Date of operation, 1890. Male, aged twenty-one years. Ill eighteen days. Synovitis(?) of knee as complication. Aspiration one day previously. Incision, fifth interspace, three inches from middle line. Not much pus evacuated, but seventeen fluidounces removed by aspiration the day before. No irrigation. Permanent drainage with rubber tube. After-treatment, thirteen days. Death. Autopsy showed much fibrinous exudate within pericardium.

CASE XXI.—(Sievers, *Zeitsch. für klin. Med.*, 1893, Vol. xxiii, p. 26.) Date of operation, 1892. Female, aged twenty-two years. Ill five weeks. Pleuropneumonia, empyema on both sides, nephritis as complications. Tapped seven days previously with trocar. Incision, third interspace, two centimetres to left of sternum. Great quantity of pus evacuated. No irrigation. Permanent drainage. After-drainage, eight days. Death. Found bacilli in fluid. Autopsy showed acute nephritis, pleuropneumonia, pericardial adhesions, and some change in heart muscle. Pericarditis was of a septicopyæmic nature. Operator chose third interspace because fourth and fifth interspaces were very narrow.

CASE XXII.—(Körte, *Verhandel. d. Berlin. med. Gesellschaft* (1892), 1893, Vol. xxiii, p. 2.) Date of operation, 1891. Female, aged seven years. Osteomyelitis of both tibiæ as complication. Tapped previously. Incision, with resection of five centimetres of fifth rib and cartilage. Evacuated half a litre of pus. Irrigation, lysol solution, ½ per cent. Permanent drainage not mentioned. After-treatment, twelve days. Death. Autopsy showed numerous foci of pus in fissures of cardiac muscle, in papillary muscles of mitral valve, and in kidneys. Caseous mass in lung and evidence of pleuritis were found. Pus evacuated contained staphylococci, streptococci, and bacilli.

CASE XXIII.—(Eiselsberg, *Wiener klin. Wochenschrift*, January 10, 1895, p. 21.) Date of operation, 1894. Male, aged seventeen years. Ill over four and one-half months. Wound made by knife in region of heart, which had healed; left pleuritis, and pneumonia followed third tapping. Tapped three times previously. Resection of fourth cartilage. Two litres of pus evacuated. Irrigation, solution of salicylic acid; then iodoform and glycerin. Permanent drainage, two tubes. After-treatment, about six weeks. Recovered. Drains kept in pericardium seventeen days.

CASE XXIV.—(Edwards, *Transactions of the Medical Society of State of California*, 1893, p. 166.) Date of operation, 1892(?). Female, aged six years. Sacculated empyema; operation with resection of ribs; mediastinitis, nephritis as complications. Not tapped previously. Incision, one-fourth inch within and above position of apex-beat. Nine fluidounces of pus evacuated. No irrigation. Permanent drainage with rubber tube. Death. Began as mediastinopericarditis, with secondary pleurisy. At least, this was the belief of Edwards after an autopsy.

CASE XXV.—(Jacobson, "Operations of Surgery," London, 1897, p. 590.) Female, aged fourteen. Œdema of lungs as complication. Incision, fifth interspace, right side, a little outside of sternum. Forty-six fluidounces of pus evacuated. Death occurred from œdema of lungs

CASE XXVI.—(Gabszwiez, *Gaz. Leklarsh*, Warsaw, 1892, Vol. ii, Series 12, p. 1070.) Date of operation, 1892. Male, aged twenty-two years. Ill about one month. No complications. Not tapped previously. Resection of fifth costal cartilage. Large quantity of pus evacuated. Irrigation, boric acid solution. Permanent drainage by iodoform gauze for eighteen days. Recovered.

CASE XXVII.—(Robinson, *Lancet*, November 21, 1896, p. 1460.) Date of operation, 1893. Male, aged sixteen years. Ill twenty days.

Sore throat and swelling of left wrist were first symptoms. Aspiration one day previous. Resection of sixth rib. Two quarts of pus evacuated. No irrigation. Permanent drainage with one drainage-tube. After-treatment, about two months. Recovered.

CASE XXVIII.—(Marsh, *Lancet,* November 21, 1896, p. 1460.) Male, aged fourteen years. Incision below nipple. No permanent drainage. After-treatment, four days. Death.

CASE XXIX.—(Klefberg, *Tidskrift i Militär,* Helsovord 17, Arg. 1892, Stockholm, from Shattuck and Porter, *Boston Medical and Surgical Journal,* May 6, 1897, p. 444.) Male, aged nineteen years. Influenza previously. Aspiration previously, and withdrawal of one hundred and fifty grammes of pus. Incision in fourth interspace. One litre of pus evacuated. After-treatment, six days. Death. Autopsy showed pus in right ankle and sternoclavicular joints.

CASE XXX.—(Bohm, *Deutsche medicinische Wochenschrift,* November 26, 1896, p. 769.) Date of operation, 1894. Male, aged thirty-three years. Ill one month. Influenza previously. Pleuropneumonia as complication. Tapped pericardium three times. Incision in third interspace. One litre of pus evacuated. Irrigated with boric acid solution. Permanent drainage with gauze. After-treatment, three months. Recovered. Schleich's infiltration method of local anæsthesia was used. Wound closed in three weeks. Out of bed in four and one-half weeks. Well a year later.

CASE XXXI.—(Allen, personal communication from Dr. D. P. Allen, Cleveland, Ohio, to Dr. Roberts.) Date of operation, 1892. Male, aged eleven years. Empyema, requiring costal resection one year before. Aspiration of pericardium previously. Resection of sixth rib below and inside of left nipple. Two quarts of pus evacuated. Irrigation with sterile water. Permanent drainage with gauze. After-treatment, twenty days. Death.

CASE XXXII.—(Stoker (O'Carroll's patient), *Dublin Journal of Medical Science,* July, 1896, p. 11.) Date of operation, 1892. Male, aged twenty years. Ill thirty-four days. Pneumonia. Left pleural effusion subsequent to operation. Aspiration of pericardium five days previously. Incision in fourth interspace midway between nipple and sternum. No irrigation. Permanent drainage on third day by tube. After-treatment, thirty days. Death. Fränkel's diplococcus found in pus.

CASE XXXIII.—(Bjorkmann or Hackzell, *Hygeia,* Stockholm, 1896, I. viii, Part 2, p. 189.) Date of operation, 1895(?). Female, aged twelve years. Ill about three and one-half weeks; had influenza and pleuropneumonia previously. Aspirated previously in fourth interspace. Resection, fifth and sixth ribs. Evacuated from 400 to 500 cubic centimetres of pus. Irrigation with boric acid solution. Permanent drainage with two drainage-tubes. Duration of treatment, six weeks. Recovered. Pleural cavity was opened and some serum evacuated by resection. The pleural opening was then closed with sutures.

CASE XXXIV.—(Porter (Shattuck's patient), *Boston Medical and Surgical Journal,* May 6, 1897, p. 438.) Date of operation, 1895. Male, aged twenty-six years. Ill thirty-three days. Pneumonia before peri-

carditis. Empyema after pericardotomy, requiring resection. Aspiration two days previously. Incision in fifth interspace one and one-half inches to left of sternum. One quart of pus evacuated. Irrigation with sterile salt solution. Permanent drainage with two rubber tubes. Recovered. Pneumococcus found in pus. Pneumothorax and empyema occurred after pericardotomy. Pneumococcus in pus from pleural sac. Erysipelas of back and shoulder occurred. On thirty-sixth day wound entirely healed. Empyema sinus finally closed in about ten months.

CASE XXXV.—(Garber, *Journal of American Medical Association*, June 26, 1897, p. 1223.) Date of operation, 1897. Female, aged twenty-one years. Ill two weeks. Pericarditis, caused by penetrating wound with steel crochet-needle. Not tapped previously. Incision in fifth interspace, one and one-half inches to the left of the sternum. Evacuated about one fluidounce of thick pus and also some purosanguinolent fluid. Irrigation with salt solution. Permanent drainage with gauze. After-treatment, twenty-four days. Recovered.

The preceding thirty-five cases are copied from Roberts's article in *Transactions of the American Surgical Association*, 1897, Vol. xv.

The following are all new cases, save cases of Pepper and Rullier, which were in Dr. Porter's former list.

CASE XXXVI.—(Brentano, *Deutsche med. Wochenschrift*, 1898, p. 506.) Child, seven years old. Complication of acute osteomyelitis. Symptoms of effusion on sixth day. Ten days later, pericardotomy after diagnostic puncture with Pravaz syringe. Resection, fifth cartilage. Much pus. Pyæmia. Death in twelve days.

CASE XXXVII.—(Brentano, ibid.) Child, seven years old. Osteomyelitis. Practically the same as above.

The operation in these two children was followed immediately by improvement in pulse and general condition, but within a few days (twelve), as shown by post-mortem, pyæmia caused death. No cultures from pus reported. At post-mortem the following unusual condition was found. Abscesses, multiple in the muscle of the heart itself in both cases, one of which in second case had perforated into the left ventricle by extensive involvement of the walls of ventricle, and caused sudden death by great hæmorrhage into the drained pericardium.

CASE XXXVIII.—(Brentano, ibid.) Male, fifteen years old. Rheumatic endocarditis and subacute serofibrinous pericarditis. Resection of

the fifth cartilage after incision, presumably in fifth space without resection, had injured pleura. Pericardium very thick, fibrinous adhesions to wall of the heart. Serofibrinous fluid. No cultures. Death in three days, with practically no improvement in symptoms.

CASE XXXIX.—(Brentano, ibid.) Male, thirty-one years old. Practically same as above, save that resection of rib cartilage was at once begun.

In these cases he thinks operation was a mistake because of the chronic cardiac and rheumatic condition. It does not appear from his article what symptoms and signs caused him to operate.

In these two cases, so adherent was heart and pericardium, puncture, he says, could hardly have failed to have done serious mischief.

CASE XL.—(Brentano, ibid.) A case of serous pericarditis following rheumatic endocarditis in a girl aged ten. Very sick case from large exudation. No puncture, but incision after resection of the fifth rib cartilage. Three hundred cubic centimetres of serosanguinolent fluid removed. No cultures reported. Immediate and marked improvement. Drainage with iodoform gauze. Fluid, clear, flowed from the wound for a day or two, but in eight days only a fine granulating dry sinus was left. Recovery.

CASE XLI.—(Lilienthal. Reported before New York Academy of Medicine, November 13, 1899, *Medical News,* November 25, 1899.) Male, fifteen years old. Trilobar pneumonia with very high fever, pneumococci in sputum, and later streptococci. Six weeks after very sick; pericardial friction sounds and dulness; aspirated, and eighteen ounces of pus, giving pure culture pneumococcus, withdrawn. Then, under eucaine local anæsthesia, incision, with resection of fourth and fifth costal cartilages; pericardial sac much thickened; pleura not opened. Forty ounces of pus. Irrigation with salt solution. Wound left open, no drainage-tubes or gauze. Recovery. Adhesion of pericardium and the heart with the scar was evident after recovery, by the retraction of the tissues at each systole.

CASE XLII.—(Allingham and Ogle, *Lancet,* March 10, 1900.) Male, twenty-six years old(?). Pericardial infection from small collection of pus in pleural cavity to right of pericardium. Chronic disease of lungs. No acute sepsis. Symptoms of pericardial effusion baffling. Incision and resection of fifth rib cartilage. Pleura not opened. Pericardium and pleuræ firmly adherent to chest wall. Sixteen ounces of non-offensive pus evacuated. No cultures. Great masses of fibrin in sac and adhering to sac and to heart. As much of this as possible removed with fingers and sponges; about five ounces back of heart could not be reached. Sac stitched to skin. Irrigation with hot water. Drainage not mentioned, but wound was left open. Temporary improvement. Death in fourteen hours. Autopsy revealed cause of infection.

CASE XLIII.—(Robinson, *British Medical Journal,* November 26, 1898.) Boy, four years old. Bronchopneumonia for three and one-half weeks. Operated when nearly moribund. Kind of anæsthesia not given. Incision over fifth cartilage, one inch removed. Pleura not opened. Ten ounces of pus and seroturbid fluid. Cultures showed pure cultures of pneumococcus. Fibrin on anterior wall pericardium. No irrigation. Gauze drainage. Marked improvement after operation for twenty-four hours. Death on third day after operation. No post-mortem.

CASE XLIV.—(Sevestre, *Lancet,* April 23, 1898.) Male, twenty-two years old. Acute pneumonia and pneumococcus pericarditis. Very sick case. Aspiration in fourth space close to left border of the sternum, twenty-three ounces of pus giving pure cultures pneumococcus. Under cocaine the next day, as preliminary to operation, aspirating needle put in the same place, with result of getting only bright blood. Three days after the operation under cocaine(?) in fourth space. No mention of pleura made. No resection. Forty-five ounces of pus evacuated. Sac washed out and drainage-tube put in. Three days after this double empyema and resection of a rib on both sides under chloroform (at intervals of two days), pneumococci in pleural pus. Death, eighteen days after first pericardial aspiration (probable infection of pleural cavities at first operation).

CASE XLV.—(C. Mansell-Moulin, *Transactions of the Clinical Society,* Vol. xxx, p. 217, 1897.) Male, twenty-eight years old. Blow over chest while playing foot-ball. Collapse, soon after followed by cardiac dulness next day with cough and pain on breathing. Continued for nearly a month with less pain and easier breathing, except that cardiac dulness increased, spreading to right of sternum. About a month after injury, sudden great dyspnœa and pain. Operation under cocaine anæsthesia. Incision through fifth space. Nothing said about resection. Pleura opened. About six pints of thin, dark, bloody fluid, which clotted very rapidly, was removed. Drainage-tube left in for twenty-four hours. Good recovery, though left lung remained collapsed for very long time. No cultures mentioned.

CASE XLVI.—(Connor and Stimson, *Medical News,* January 20, 1900.) Sex and age unknown. Severe pneumonia. Operation under local anæsthesia. Pleura (right opened), incision not given. Death in a few days.

CASE XLVII.—Bexman. Incision in second space for purulent pericarditis. Recovery. Mentioned by Voinitsch-Sianojewsky elsewhere.

CASE XLVIII.—(Ljunggren. Translated from history of the case in *Nordisk Med. Arkiv.,* Stockholm, 1898, Band ix, Heft 6, New Series.) Male, laborer, twenty-four years old. Well previously, save that some years before had disease in his left lung, the nature of which he did not know. On October 28, 1896, had a severe chill with fever, also shortness of breath and coughing, and pain in the left breast in front. Could not get up. Could not lie on the left side without very difficult breathing. Cough and fever continued till he was admitted to hospital the 17th of November. On entering hospital this condition was noted: The left half of chest is more prominent than the right, with dulness on percussion over

whole left front from second rib down; this dulness reached to about one centimetre to the right of the right sternal border and over the entire lower half of the thorax to the back and as high as the top of the scapula. Respiratory sounds could not be heard over any of this dull area. Heart beats could not be felt. Heart sound could be heard, though faintly. Distention of abdomen, especially epigastric. Liver dulness lost. Breathing of the costal type and frequent. The face was cyanosed and anxious. There was some œdema of the feet. Temperature was 39.5° C. Pulse even and weak, 110. Pain over left chest, and difficulty in breathing complained of by patient. Under expectant treatment he became worse each day. Tapped twice in the back for supposed empyema without result, no fluid found. As the fever lessened, breathing became more difficult and heart's action weaker. Aspiration (diagnostic) with hypodermic needle in the fifth intercostal space a little below and inside of the left nipple, where fluctuation was felt. Under a small amount of chloroform an incision in fifth space beginning two centimetres inside and below nipple and ending six centimetres outside. The pleura was adherent. Pericardium opened with great spouting up of pus as result. Collapse of patient, pulse stopped, but compression of left ventricle of heart with operator's fingers caused renewed beating, after this the sac was emptied slowly. Heart was close up to sac wall with a few adhesions between. One and one-half litres of bright green pus were removed. The most of the fluid was localized back and at the sides of the heart. Drainage-tubes to back of sac. From pus several cultures were taken, but growths were doubtful. Microscopic examination showed short bacilli that often lay two and two. Cultures from fluid on second day gave bacillus pyocyaneus. Steady improvement. On second day considerable fibrin in lumps came from wound. At end of a week after operation no fever and very little difficulty in breathing. At second week after irrigation with salt solution brought away coagula of fibrin. Irrigation about every three days. Because of contraction of sinus through the fifth space, operated on again to get more room for irrigation and resected the fifth rib, and through this larger opening kept on trying to keep sac clear of fibrin, etc., by irrigation. After this second operation, steady improvement and ultimate recovery. One year after operation normal cardiac dulness and minute fistula, which discharged occasionally.

Case XLIX.—(Riedel, *Centralbl. f. Chir.*, 1897, p. 59.) Man. Pistol wound. Ten days afterwards resection of several ribs and opening of pericardium. Sanguinolent fluid. Could not drain the sac because of tubes causing irregular pulse. Death. No other details given.

SYNOPSIS OF CASES OF OPERATION FOR SUPPURATIVE PERICARDITIS.

Case I.—Male, twenty-five years. *Operator,* Hilsmann. *Reference and Date,* Inaug. Dissert., Kiel, 1875; date of operation, 1844. *Etiology* not given. ***Incision and Technique,*** fourth interspace near sternum; pericardium opened without first aspirating. *Irrigation, Drainage,* no irrigation; daily probing of wound. *Result,* recovered in three months.

CASE II.—(?). *Operator,* Langenbeck. *Reference and Date,* Vorlesungen über Chirurgie, p. 449, Berlin, 1888. *Etiology,* gunshot wound, with necrosis of fifth rib. *Incision and Technique,* incision through lost rib substance. *Irrigation, Drainage,* no irrigation; drainage (?). *Result,* recovered.

CASE III.—Male, sixteen years. *Operator,* Rosenstein. *Reference and Date,* Berlin. k. Wochen., January 31, 1881; operation, 1879. *Etiology,* pleurisy (?); as to primary cause, etiology doubtful. *Incision and Technique,* tapped once; incision in fourth space near sternum. *Irrigation, Drainage,* no irrigation; drained with rubber tubes. *Result,* recovered in two months. *Remarks, Bacteriology,* very large quantity of pus in sac.

CASE IV.—Male, sixteen years. *Operator,* West. *Reference and Date,* Medico-Chirurgical Transactions, 1883, p. 235. *Etiology,* etiology (?); perhaps tubercular; no complications. *Incision and Technique,* tapped first; incision in fifth space, line of nipple. *Irrigation, Drainage,* irrigation; carbolic 1-40; tube drainage. *Result,* recovered in five months. *Remarks, Bacteriology,* two quarts of pus. Rod-shaped bacteria tubercle bacillus(?).

CASE V.—Male, twenty-three years. *Operator,* Partzevsky. *Reference and Date,* London Medical Record, February 15, 1883. *Etiology,* pleurisy (?). *Incision and Technique,* tapped twice; then incision in fourth space. *Irrigation, Drainage,* irrigation with salicylic acid; double-tube drainage. *Result,* death in thirty hours.

CASE VI.—Male, fourteen years. *Operator,* West. *Reference and Date,* British Medical Journal, December 8, 1883, and February 21, 1891. *Etiology,* Pneumonia and general sepsis. *Incision and Technique,* opened in operation for pleural effusion; site (?). *Irrigation, Drainage,* (?). *Result,* death in fourteen days. *Remarks, Bacteriology,* cause of death, general sepsis.

CASE VII.—Male, nine years. *Operators,* Savory, Brinton, Collyns. *Reference and Date,* St. Bartholomew's Hospital Reports, 1883, Vol. xix, p. 279. *Etiology,* septic pneumonia and pleurisy from multiple abscesses. *Incision and Technique,* incision in fifth space; pleura opened. *Irrigation, Drainage,* irrigation with Condy's fluid; tube drainage. *Result,* death in fifteen days. *Remarks, Bacteriology,* cause of death, pyæmia. Incision in anterior axillary line for empyema primarily.

CASE VIII.—Male, six years. *Operator,* Scott. *Reference and Date,* New Zealand Medical Journal, July, 1891, p. 268. *Etiology,* unknown; no complications. *Incision and Technique,* tapped once; incision in fifth space near apex of heart; pleura not mentioned. *Irrigation, Drainage,* irrigation with 1½ per cent. carbolic; two tube drains. *Result,* recovered; time (?). *Remarks, Bacteriology,* two incisions one inch apart; drain in each.

CASE IX.—Male, thirty-two years. *Operator,* Newman or Sterling. *Reference and Date,* Australian Medical Journal, July 15, 1885. *Etiology,* typhoid fever and pleurisy. *Incision and Technique,* aspirated five times; cut in third space, old trocar track. *Irrigation, Drainage,* irrigation,

iodine 1 to 10; tube drain. *Result,* death in five days. *Remarks, Bacteriology,* 174 ounces pus removed by five tappings.

CASE X.—Female, thirty-five years. *Operator,* Mikhailor. *Reference and Date,* London Medical Record, August 15, 1885. *Etiology,* bronchitis and pleural lesion (?). *Incision and Technique,* tapped previously; cut in fourth space near sternum; pleura not mentioned. *Irrigation, Drainage,* boric acid; tube. *Result,* death in eighteen hours. *Remarks, Bacteriology,* bacteriological examination of sac (?) at autopsy was negative.

CASE XI.—Male, thirteen years. *Operator,* Gussenbauer. *Reference and Date,* Wien. med. Wochen., November 22, 1884. *Etiology,* osteomyelitis, acute. *Incision and Technique,* resection of fifth rib; pleura opened. *Irrigation, Drainage,* thymol solution; sac stitched up. *Result,* recovered; time (?).

CASE XII.—Male, ten years. *Operators,* Rouse and Dickinson. *Reference and Date,* Transactions of the Clinical Society, 1889, p. 48. *Etiology,* abscesses of buttocks and fingers, with pleurisy. *Incision and Technique,* tapped three times; cut in fifth space on right; pleura not mentioned. *Irrigation, Drainage,* no irrigation; tube drainage. *Result,* recovered in two and one-half months.

CASE XIII.—Female, six years. *Operator,* Underhill. *Reference and Date,* Edinburgh Hospital Reports, 1896, p. 200. *Etiology,* pyæmia from periostitis tibiæ. *Incision and Technique,* tapped twice; incision in fifth interspace near sternum. *Irrigation, Drainage,* no irrigation; tube drainage. *Result,* death in five days. *Remarks, Bacteriology,* cause of death, pyæmia and hæmorrhages from interior of pericardium.

CASE XIV.—Female, nine years. *Operator,* Parker. *Reference and Date,* Transactions of the Clinical Society, London, 1889, Vol. xxii, p. 60. *Etiology,* osteomyelitis and arthritis. *Incision and Technique,* tapped incision and resection of fifth cartilage; pleura not opened. *Irrigation, Drainage,* irrigation; death during this. *Result,* death on table. *Remarks, Bacteriology,* cause of death said to have been pressure on heart through poor return of irrigation fluid.

CASE XV.—Male, thirty-six years. *Operator,* Halsted. *Reference and Date,* University Medical Magazine, Vol. vi, p. 248; date of operation, 1890. *Etiology,* necrosis of nasal bones. *Incision and Technique,* incision in fourth space halfway between nipple and sternum; pleura not mentioned. *Irrigation, Drainage,* no irrigation; gauze drain. *Result,* death in seventeen days; pyæmia.

CASE XVI.—Male, (?). *Operator,* Delorme. *Reference and Date,* Revue de Chirurgie, 1895, Vol. xv, p. 1008. *Etiology,* empyema. *Incision and Technique,* incision in fourth space near sternum; only few drops of pus. *Irrigation, Drainage,* no irrigation or drainage. *Result,* death in few minutes. *Remarks, Bacteriology,* autopsy showed that anterior wall of heart was adherent; about a pint of pus was behind and at the sides of the adherent heart.

CASE XVII.—Male, six years. *Operator,* Davidson. *Reference and Date,* British Medical Journal, March 14, 1891. *Etiology,* pyæmia and septic pneumonia after necrosis of metatarsus. *Incision and Technique,*

aspiration; incision in fifth space. *Irrigation, Drainage,* no irrigation; tube drain. *Result,* death in seven days from sepsis.

CASE XVIII.—Male, six and three-quarters years. *Operator,* Davidson, second case. *Reference and Date,* British Medical Journal, March 14, 1891. *Etiology,* empyema. *Incision and Technique,* not tapped; first incision in fourth space near sternum. *Irrigation, Drainage,* no irrigation; tube drain. *Result,* recovered in seven weeks.

CASE XIX.—Female, eleven years. *Operator,* Teale or Bromer. *Reference and Date,* British Medical Journal, February 14, 1891. *Etiology,* pneumonia and empyema. *Incision and Technique,* tapped; first incision in fourth space one inch from sternum. *Irrigation, Drainage,* boric and carbolic acid, iodoform, glycerin; tube drain. *Result,* death in twenty-six days. *Remarks, Bacteriology,* no autopsy.

CASE XX.—Male, twenty-one years. *Operator,* Deaver. *Reference and Date,* University Medical Magazine, 1894, Vol. vi, p. 297. *Etiology,* synovitis knee, probably septic. *Incision and Technique,* aspiration; incision in fifth space three inches from median line. *Irrigation, Drainage,* no irrigation; tube drain. *Result,* death in thirteen days. *Remarks, Bacteriology,* autopsy showed much fibrinous exudate in sac.

CASE XXI.—Female, twenty-two years. *Operator,* Sievers. *Reference and Date,* Zeitschrift f. klin. Med., 1893, xxiii, p. 26. *Etiology,* pneumonia and empyema (right). *Incision and Technique,* tapped seven days earlier; incision in third space near sternum; left pleura opened. *Irrigation, Drainage,* no irrigation; tube drain (?). *Result,* death in eight days; pyæmia. *Remarks, Bacteriology,* bacilli (?) in pus; left empyema after operation.

CASE XXII.—Female, seven years. *Operator,* Körte. *Reference and Date,* Verhdl. d. Berlin. med. Gesellschaft, 1893, xxiii, 2; date of operation, 1891. *Etiology,* osteomyelitis of both tibiæ. *Incision and Technique,* tapped previously; resection of fifth rib and cartilage. *Irrigation, Drainage,* irrigation, lysol, ½ per cent.; drainage (?). *Result,* death in twelve hours from sepsis. *Remarks, Bacteriology,* pus, streptococci, staphylococci, and bacilli; abscess in heart wall found at autopsy.

CASE XXIII.—Male, seventeen years. *Operator,* Eiselsberg. *Reference and Date,* Wien. klin. Wochenschrift, January 10, 1895. *Etiology,* stab wound four and one-half months previously. *Incision and Technique,* tapped three times; resection of the fourth cartilage. *Irrigation, Drainage,* salicylic acid and iodoform glycerin; two tubes for seventeen days. *Result,* recovered in six weeks. *Remarks, Bacteriology,* early tapping caused pleurisy; pneumonia. Colon bacilli in fluid.

CASE XXIV.—Female, six years. *Operator,* Edwards. *Reference and Date,* Transactions of the Medical Society of California, 1893. *Etiology,* empyema, and operation for same; "mediastinitis" (?). *Incision and Technique,* incision one-half inch within and above apex-beat. *Irrigation, Drainage,* no irrigation; tube drain. *Result,* death. *Remarks, Bacteriology,* question as to priority of pericarditis or empyema.

CASE XXV.—Female, fourteen years. *Operator,* Jacobson. *Reference and Date,* "Operations of Surgery," London, 1897, p. 590. *Etiology,* un-

known. *Incision and Technique,* incision in right fifth space close to sternum. *Irrigation, Drainage,* (?). *Result,* death from œdema of lungs.

CASE XXVI.—Male, twenty-two years. *Operator,* Gabszwiez. *Reference and Date,* Roberts's list, also Gaz. Leklarsh of Warsaw, 1892, second series. *Etiology,* unknown. *Incision and Technique,* resection of fifth cartilage. *Irrigation, Drainage,* boric acid, iodoform; gauze drain for eighteen days. *Result,* recovered.

CASE XXVII.—Male, sixteen years. *Operator,* Robinson. *Reference and Date,* Lancet, November 21, 1896, p. 1460. *Etiology,* sore throat, (?) septic. *Incision and Technique,* tapped previously; resection of sixth rib; left pleura opened. *Irrigation, Drainage,* no irrigation; tube drain. *Result,* recovered in two months. *Remarks, Bacteriology,* two quarts of pus; no cultures.

CASE XXVIII.—Male, eighteen years. *Operator,* Marsh. *Reference and Date,* Lancet, November 21, 1896, p. 1460. *Etiology,* not given or unknown. *Incision and Technique,* Incision below the nipple. *Irrigation, Drainage,* (?); no permanent drainage. *Result,* death in four days.

CASE XXIX.—Male, nineteen years. *Operator,* Klefburg, of Stockholm. *Reference and Date,* Dr. Porter's and Roberts's lists. *Etiology,* influenza. *Incision and Technique,* tapped previously; incision in fourth space; local anæsthesia. *Irrigation, Drainage,* (?). *Result,* death in six days; general sepsis.

CASE XXX.—Male, thirty-three years. *Operator,* Bohm. *Reference and Date,* Deutsche med. Wochenschrift, November 26, 1896. *Etiology,* influenza and pneumonia. *Incision and Technique,* tapped three times; incision in third space; local anæsthesia, Schleich. *Irrigation, Drainage,* boric acid; gauze drain. *Result,* recovered in four and one-half weeks.

CASE XXXI.—Male, eleven years. *Operator,* Allen, of Cleveland. *Reference and Date,* Roberts's list; date of operation, 1892. *Etiology,* (?) of old empyema. *Incision and Technique,* tapped previously; resection of sixth rib below and inside nipple. *Irrigation, Drainage,* sterile water; gauze drain. *Result,* death in twenty days.

CASE XXXII.—Male, twenty years. *Operator,* Stoker (O'Carroll's case). *Reference and Date,* Dublin Journal of Medical Sciences, July, 1896; date of operation, 1892. *Etiology,* pneumonia and pleural effusion. *Incision and Technique,* tapped previously; incision in fourth interspace between nipple and sternum. *Irrigation, Drainage,* no irrigation; tube drain. *Result,* death in thirty days. *Remarks, Bacteriology,* pneumococcus in pus.

CASE XXXIII.—Female, twelve years. *Operator,* Bjorkmann or Hackzell, of Stockholm. *Reference and Date,* Roberts's list. *Etiology,* influenza and pneumonia. *Incision and Technique,* tapped previously; resection of fifth and sixth ribs; pleura opened and sutured. *Irrigation, Drainage,* boric acid solution; two tubes. *Result,* recovered in six weeks.

CASE XXXIV.—Male, twenty-six years. *Operator,* C. B. Porter. *Reference and Date,* Boston Medical and Surgical Journal, May 6, 1897; also Transactions of the American Surgical Association, 1897. *Etiology,* pneumonia. *Incision and Technique,* tapped previously; incision in fifth

space one and one-half inches to left of sternum. *Irrigation, Drainage,* salt solution; two tubes. *Result,* recovered. *Remarks, Bacteriology,* empyema; pneumothorax after operation. Pneumococcus in pus from pericardium and empyema.

CASE XXXV.—Female, twenty-one years. *Operator,* Garber. *Reference and Date,* Journal of the American Medical Association, June 26, 1897. *Etiology,* stab wound, needle, two weeks before. *Incision and Technique,* incision in fifth space one and one-half inches left of sternum. *Irrigation, Drainage,* salt solution; gauze drain. *Result,* recovered in twenty-four days. *Remarks, Bacteriology,* sanguinolent fluid and about one ounce of pus; no cultures.

The above thirty-five cases are all given in Roberts's list.

The following sixteen cases (two in Dr. Porter's list, Pepper's case and Rullier's) have been found and tabulated.

CASE XXXVI.—*Operator,* Beman. *Reference and Date,* cited by Voinitsch-Sianojewsky, Revue de Chirurgie, 1898, p. 993; date of operation, 1892. *Etiology,* unknown. *Incision and Technique,* incision in second space. *Irrigation, Drainage,* (?). *Result,* recovered.

CASE XXXVII.—Male, age (?). *Operator,* Riedal. *Etiology,* pistol wound ten days before. *Incision and Technique,* resection of several ribs and opening pericardium; no details given. *Irrigation, Drainage,* (?); no drainage. *Result,* death. *Remarks, Bacteriology,* bloody, thin fluid; no cultures. Resection of rib to drain right pleura after wound; for pericardotomy ten days later.

CASE XXXVIII.—*Operator,* Ljunggren, of Stockholm. *Reference and date,* Nord. med. Arkiv., U. S., 1898, Band ix, Heft 6. *Etiology,* acute pneumonia. *Incision and Technique,* diagnostic aspiration; incision in fifth space between sternum and nipple; later resection of fifth rib. *Irrigation, Drainage,* salt solution; two tubes. *Result,* recovered. *Remarks, Bacteriology,* bacillus pyocyaneus in pus which was green in color.

CASE XXXIX.—Male, fifteen years. *Operator,* Lilienthal. *Reference and Date,* Medical News, November 25, 1899. *Etiology,* severe double pneumonia. *Incision and Technique,* aspirated once; incision with resection of fourth and fifth cartilages with eucaine; pleura not opened. *Irrigation, Drainage,* salt solution; no drain; wound left open. *Result,* recovered in six weeks. *Remarks, Bacteriology,* pneumococcus in pus in pure culture; pneumococcus and streptococcus in sputum.

CASE XL.—Male, twenty-six years. *Operators,* Allingham and Ogle. *Reference and Date,* Lancet, March 10, 1900. *Etiology,* old purulent encysted pleurisy; no acute course. *Incision and Technique,* resection of fifth cartilage; pleura not opened. *Irrigation, Drainage,* hot water; sac stitched up; no drain. *Result,* death in fourteen hours. *Remarks, Bacteriology,* sixteen ounces of pus, no cultures. Much fibrin in pus.

CASE XLI.—Male, four years. *Operator,* Robinson (his second case). *Reference and Date,* British Medical Journal, November 26, 1898. *Etiology,* severe broncho-pneumonia. *Incision and Technique,* resection of fifth cartilage; pleura not opened. *Irrigation, Drainage,* no irrigation;

gauze drain. *Result,* death in three days. *Remarks, Bacteriology,* seropurulent fluid giving pure pneumococcus culture.

CASE XLII.—Male, twenty-two years. *Operator,* Sevestre. *Reference and Date,* Lancet, April 23, 1898. *Etiology,* acute pneumonia. *Incision and Technique,* aspiration; under cocaine, incision in fourth space; pleura not mentioned. *Irrigation, Drainage,* hot water; tube drain. *Result,* death in twelve days. *Remarks, Bacteriology,* pneumococcus pure. Double empyema with double rib resections later.

CASE XLIII.—Male, twenty-eight years. *Operator,* Mansell-Moulin. *Reference and Date,* Clinical Society Transactions, 1897, Vol. xxx, p. 217. *Etiology,* blow on chest one month before. *Incision and Technique,* under cocaine, incision in fifth space; pleura opened. *Irrigation, Drainage,* no irrigation; tube for twenty-four hours. *Result,* recovery. *Remarks, Bacteriology,* thin, bloody fluid; no cultures. Lung collapsed for long time.

CASE XLIV.—(?). *Operators,* Connor and Stimson. *Reference and Date,* Medical News, January 20, 1900. *Etiology,* acute pneumonia, severe. *Incision and Technique,* under cocaine, incision on left, location not given; right pleura opened. *Irrigation, Drainage,* (?). *Result,* death in a few days.

CASE XLV.—Child, seven years. *Operator,* Brentano, first case. *Reference and Date,* Deutsche med. Wochenschrift, 1898, p. 506. *Etiology,* acute osteomyelitis. *Incision and Technique,* resection of fifth cartilage; pleura not opened. *Irrigation, Drainage,* irrigation; drainage with iodoform gauze. *Result,* death in ten days. *Remarks, Bacteriology,* no cultures; death due to pyæmia; abscess in heart wall.

CASE XLVI.—Child, seven years. *Operator,* Brentano, second case. *Reference and Date,* Deutsche med. Wochenschrift, 1898, p. 506. *Etiology,* acute osteomyelitis. *Incision and Technique,* resection of fifth cartilage; pleura not opened. *Irrigation, Drainage,* irrigation; drainage with iodoform gauze. *Result,* death in ten days. *Remarks, Bacteriology,* profuse hæmorrhage from sac, from ruptured heart, cause of death.

CASE XLVII.—Male, fifteen years. *Operator,* Brentano, third case. *Reference and Date,* Deutsche med. Wochenschrift, 1898, p. 506. *Etiology,* rheumatism, endocarditis. *Incision and Technique,* resection of fifth cartilage; pleura injured. *Irrigation, Drainage,* irrigation; iodoform gauze drain. *Result,* death in three days. *Remarks, Bacteriology,* serofibrinous fluid in sac; no cultures.

CASE XLVIII.—Male, thirty-one years. *Operator,* Brentano, fourth case. *Reference and Date,* Deutsche med. Wochenschrift, 1898, p. 506. *Etiology,* rheumatism, endocarditis. *Incision and Technique,* resection of fifth cartilage; pleura not cut. *Irrigation, Drainage,* irrigation; iodoform gauze drain. *Result,* death. *Remarks, Bacteriology,* serofibrinous fluid; no cultures; heart adherent.

CASE XLIX.—Female, ten years. *Operator,* Brentano, fifth case. *Reference and Date,* Deutsch. med. Wochenschrift, 1898, p. 506. *Etiology,* rheumatism, endocarditis. *Incision and Technique,* resection of fifth cartilage. *Irrigation, Drainage,* irrigation; iodoform gauze drain. *Result,*

recovery in ten days. *Remarks, Bacteriology,* serous fluid only; no cultures.

CASE L.—Male, nineteen. *Operator,* Pepper, C. B. Porter's list. *Reference and Date,* University Medical Magazine, February, 1894. *Etiology,* influenza. *Incision and Technique,* aspiration first; small incision and tube in fifth space. *Irrigation, Drainage,* (?). *Result,* death in two days. *Remarks, Bacteriology,* at autopsy little pus, but whole sac distended with fibrin.

CASE LI.—*Operator,* Rullier, C. B. Porter's list. *Reference and Date,* see Dr. Porter's paper. *Etiology,* serous pericarditis. *Incision and Technique,* tapped four times; iodine injected; incision in fourth space. *Result,* recovered.

BIBLIOGRAPHY FROM 1897 TO 1900 (APRIL).

HEART AND PERICARDIUM.

Voinitsch-Sianojewsky: Annales de Chirurg., Russe, 1897, xiii, ii, f. 3. Revue de Chirurgie, 1898, Vol. xviii, p. 993.

Eichel: Die Schussverletzungen des Herzbeutels, Archiv f. klin. Chir., Band lix, Heft 1, 1899. ANNALS OF SURGERY, Vol. xxx, p. 658, 1889.

Eichel: Lehrbuch der Topographische Chirurg-Anatomie von Joessel und Waldeyer, Bonn, 1899. Ferrier et Reymond, "Surgery of Heart and Pericardium," Paris, 1898.

Riedel: Verband der Deutsche Gesellschaft für Chir., Twenty-sixth Congress, 1897, S. 72. Centralblatt f. Chir., 1897, p. 56.

Brentano: Deutsche med. Wochenschrift, 1898, Vol. xxxii, p. 506.

Schaposchnikoff: Russisch. Archiv f. Pathologie klin. Med. und Bacteriolog. von Padw., July, 1896. Deutsche med. Wochenschrift, 1898, No. 38, p. 611.

Körte: Deutsche med. Wochenschrift, 1898, p. 170.

Delorme: Gazette des Hôpitaux, 1898, p. 1150.

H. Allingham: Lancet, March 10, 1900.

Ljunggren: Nord. Med. Ark., New Series, 1899, Vol. ix, No. 28. ANNALS OF SURGERY, 1899, Vol. xxx, p. 659.

Lilienthal: Journal of the American Medical Association, 1899, Vol. xxxiii, p. 1422. Medical News, November 25, 1899.

C. Mansell-Moulin: Transactions of the Clinical Society, 1897, Vol. xxx, p. 217.

Sevestre: Lancet, 1898, April 23.

H. Betham Robinson: British Medical Journal, November 26, 1898, Vol. ii, p. 1605.

Wehr: Archiv f. klin. Chir., Band lix, p. 949.

Manges: Medical News, January 20, 1900.

Connor and Stimson: Medical News, January 20, 1900.

Loison: Revue de Chir., 1899, Vol. xix.

Podrey: Revue de Chir., 1899, Vol. xix.

THE RADICAL CURE OF INGUINAL HERNIA IN THE FEMALE.[1]

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According to the carefully prepared statistics of Macready, 8.5 per cent. of hernia are female inguinal; 5.9 per cent., female femoral, and 2.1 per cent., male femoral. Thus the number of cases of inguinal hernia in the female exceeds the total number of femoral hernia in both sexes, and forms 60 per cent. of all cases of rupture in women.

A careful study of the literature of the radical cure of hernia has convinced me that the treatment of inguinal hernia in the female has not yet received the attention it deserves. While most authorities agree that inguinal herniæ in female children are more amenable to cure by mechanical treatment than those in the male, my own experience has led me to believe that this difference is very slight. In a considerable number of female children with hernia the rupture persists after years of truss treatment. Such patients should, I believe, be subjected to operation. When the hernia develops during the period of youth or early adult life, a cure is very seldom effected by a truss, and in these cases operation should be urged at once without awaiting the result of mechanical treatment.

There is at present little unanimity among surgeons as to the best method of operating upon this variety of hernia; and since no series of cases sufficiently large to warrant conclusions of value has as yet been published, I may be excused for here presenting the results of operation in 123 personal cases.

Championnière was, I believe, the first to point out the advantages of operative treatment in inguinal hernia in the

[1] Read before the New York Surgical Society, May 23, 1900.

female. The method he advocated was to excise the round ligament along with the sac, closing the wound in the same manner as in the male.

Howard Kelly, in his recent work on "Operative Gynæcology," states that "the general principles of the operation are the same as in the operation for hernia in the linea alba, making the necessary changes to adapt the steps to the altered anatomical conditions." He further states that "if the hernial sac is small, there is no necessity of excising it, as the operation will be quite as effective without this step." In regard to the method of dealing with the round ligament, Kelly says, "If the round ligament is closely adherent to the sac, as is the case in strangulated or incarcerated hernia, I do not attempt to isolate it, but to excise it with the sac." In other cases he transplants it in the upper angle of the wound, having first cut up the internal oblique muscles, precisely as Halsted transplants the cord in the male, and closes the wound by interrupted mattress sutures of silver wire.

The opinion of Kelly that the removal of the sac is of little importance, especially in small herniæ, is, I believe, erroneous, and likely to do much harm. To show that the removal of the sac is of the greatest importance, I would cite a series of cases of hernia in children observed at the Hospital for Ruptured and Crippled during the years 1888 and 1889.

In seven cases in which the sac was not found, four relapsed in a few months, and two were not traced. I have never as yet seen a case in which the sac could not be readily found, and with a little care and patience it may always be dissected from the round ligament and tied off on a level with the general parietal peritoneum.

As to the necessity or desirability of transplanting the round ligament, I believe it is never indicated. It decidedly complicates the technique of the operation, and if, as I hope to be able to show, perfect results can be obtained without this step, the simpler operation should be preferred.

The method that I have employed in 123 cases is practically Bassini's method as performed in the male, the single

step of transplanting the cord being omitted. The incision is made one-half to three-fourths of an inch above and parallel to Poupart's ligament, and should extend nearly to the level of the anterior superior spine. The aponeurosis of the external oblique is slit up well over the internal ring and dissected back to the edge of the rectus on the inner side and on the outer sufficiently far to expose the thick fold of Poupart's ligament. If the sac is sought for high up just below the edge of the internal oblique muscle, there will be no difficulty in finding it. After the sac has been dissected from the round ligament and thoroughly freed well within the external ring, it is transfixed and tied off with catgut. The wound is then closed in three layers as in Bassini's method, a medium-sized kangaroo tendon being used for all buried sutures and catgut for the skin. In the deep layer, interrupted sutures, usually four or five in number, are introduced from above downward, bringing the internal oblique and transversalis muscle over to Poupart's ligament. The round ligament is allowed to drop back into the lower angle of the wound, and as it approaches the pubic bone it is so small that it requires much less space than the cord in the male. The aponeurosis is now sutured with a continuous suture of kangaroo tendon, about the size of a number one catgut. The skin is closed without drainage, and the wound dressed according to the practice that I have used in all hernia cases the past ten years, viz., with iodoform gauze and moist bichloride gauze 1-5000.

This method of operation and dressing has given such admirable results as regards primary union that I have been loth to change. Prior to December, 1898, when I began to use rubber gloves for assistants and cots or gloves for myself, I had 96 per cent. of primary wound healing; and since this date I have had 150 cases of hernia,[1] with but one suppuration, which was proved bacteriologically to have been due to imperfect sterilization of the skin of the operative field rather than to defective technique.

[1] Including cases up to October 1, 1900, this number has been increased to 200 cases, with only one case of suppuration.

As bearing on the necessity of wearing rubber gloves during operation, I would cite the bacteriological findings in thirty-five examinations. Scrapings beneath the nails of the surgeons: In eighteen cases no growths were found; in seventeen various forms of bacteria were present; in seven cases diplococci; in two cases streptococci. In the majority of instances the chloride of lime method was used for the sterilization of the hands.

Sterilizations of the skin of the field of operation were successful in the large majority of cases.

Of sixty-eight cases in which portions of the skin were removed from the field of operation just before the primary incision was made, fifty-three were found to be sterile; while in fifteen only were there bacterial growths. Of these streptococci were found once; diplococci, five times. The presence of these organism had little, if any, influence upon the wound healing, with the exception of one case in which streptococci were found. In this case, although gloves were worn by the surgeon and the assistants, the operation was perfectly simple and rapidly performed. A sudden rise of temperature occurred twenty-four hours after the operation, and continued high until the dressing was removed. At the end of forty-eight hours extensive suppuration was found, extending down to the deep fascia, and a culture made from the base showed a pure culture of streptococcus, proving that in this instance infection was due to the imperfect sterilization of the skin.

Before giving the results of operation, I will briefly discuss the question of the best suture material for hernia operations. With all that has been written on the subject, the question is far from settled. That good results may be obtained by almost any form of suture cannot be questioned; but it being our aim to obtain not merely good results, but the best possible results, it behooves us to study most carefully the question of suture material. For the sake of brevity, I will make mention of but two classes of sutures,—non-absorbable and absorbable.

While catgut was originally employed by Steele, Czerny,

and many others, in the earlier cases of operation for hernia, after the introduction of antiseptic surgery, the difficulty of perfectly sterilizing catgut soon led most of the continental and many of the American surgeons to abandon it, and to adopt some form of non-absorbable suture, viz., silk, silver wire, and silkworm gut, all of which could be rendered perfectly sterile by boiling. While methods of preparing absorbable sutures have greatly improved, so that such sutures can easily be rendered absolutely and invariably sterile, the old prejudice against them still exists in the minds of many leading surgeons to-day; and at the recent meeting of the American Surgical Association a well-known surgeon stated that he never used catgut because he believed it was impossible to sterilize it. That this is a mistaken opinion can be amply proven both by clinical and bacteriological results. At the Hospital for Ruptured and Crippled during the past ten years both catgut and kangaroo tendon have been used by Dr. Bull and myself, and frequent bacteriological tests have always shown the suture material sterile.

The clinical results as regards primary union, not having been equalled by the results obtained in cases in which non-absorbable sutures were used, fully confirm this view. The disadvantages of buried non-absorbable sutures have been pointed out repeatedly, and the only reason why many surgeons still cling to them is, I think, the mistaken belief that absorbable sutures cannot be entirely relied upon. This opinion will linger so long as surgeons of prominence continue to attribute all their failures to secure primary union to the buried absorbable suture. I have listened to arguments offered in all seriousness by good surgeons in support of the contention that the catgut or the kangaroo tendon suture were responsible for their cases of suppuration. In a recent number of a well-known medical journal there is reported a case with the following headline in large type: "Suppuration after Hernia from a Deep Suture of Van Horn's Kangaroo Tendon." The hernia recurred; the surgeon again operated, this time using silver wire. He stated that he had reported this case "to

illustrate the uncertainty in herniotomy, as well as in other operations, of Van Horn's kangaroo tendon." Nothing is said as to whether rubber gloves were worn at the operation, nor whether the skin of the field of operation had been examined bacteriologically and pronounced sterile. In the absence of such data, it seems strange that the kangaroo tendon should alone be held responsible for the failure. As presumptive evidence that it was not responsible, I will say that Van Horn's tendon and catgut sutures have been used by Dr. Bull and myself for nearly ten years, and frequent bacteriological tests have always shown them sterile.

Silver wire, which was introduced in hernia operations by Mitchell Banks, of Liverpool, in 1882, has recently been very strongly advocated by Halsted and Bloodgood at the Johns Hopkins Hospital. Yet, one need look no further than Bloodgood's own report to find ample evidence that non-absorbable sutures should be discarded in all operations for the radical cure of hernia. In 320 cases, suppuration occurred in forty-six cases, or 14.37 per cent. Four patients returned at periods from one week to four months after leaving the hospital with sinus formations or stitch abscesses. In one case there occurred three stitch abscesses and suppuration during eight months after operation. Bloodgood notes the more or less steady improvement in results as regards primary wound healing. Thus, with silk sutures, in 1889 and 1890, 36.36 per cent. suppurated; in 1890 and 1891, 26 per cent. suppurated. Curiously enough, in 1892 and 1893, in seventeen cases no suppuration occurred; while in 1894 and 1895 in nine cases 55 per cent. suppurated. Silver wire was substituted for silk in 1894, and of thirty-seven cases, four, or 10.8 per cent., suppurated; while during the years 1898 and 1899, of eighty-seven cases, only four, or 6.6 per cent., suppurated. Bloodgood states that of 116 cases in which silk was used for the buried sutures, suppuration occurred in 24 per cent.; while in 330 cases in which silver wire was used, suppuration occurred in but 4.2 per cent. This at first sight would appear indubitable proof of the superiority of silver wire over silk, yet, on closer

study, it will be seen that it proves nothing. It will be found that the striking improvement in results following the use of silver wire is practically synchronous with the introduction of rubber gloves as a routine measure, whereas the gloves were not used in the cases in which silk was employed. This fact, combined with increased familiarity with the technique of the operation and consequently smaller amount of laceration of the parts, would entirely account for this difference in primary wound healing without attributing it to any inherent advantages of silver wire over silk sutures.

With the more general use of rubber gloves and other improvements in technique, we may, I think, assume that the cases of radical cure of hernia which fail of primary wound healing will grow steadily fewer and fewer in number, no matter what form of suture is used. Yet the fact cannot be emphasized too strongly that it is NOT ALONE in cases which suppurate that sinuses develop; but they may occur in cases which heal by perfect primary union, and they may occur months and years after operation. I have observed one such case in which a sinus occurred six months, another two years and a half, and a third three years and eight months after operation, silkworm-gut sutures being extracted each time. Bloodgood states that, of twenty-two cases of more extensive suppuration of the wounds closed with silk, only three cases healed without the discharge of some of the deep sutures; while of thirteen similar cases in which silver wire was used, nine cases healed in two to five weeks, and in four cases only was sinus formation observed. This does not necessarily mean that no others occurred, inasmuch, as out of the thirty cases of late sinus formation observed at the Hospital for Ruptured and Crippled, scarcely a single patient had returned to the hospital at which the operation had been performed.

What advantages do the non-absorbable sutures then possess to offset these serious disadvantages, consisting not merely in slow healing and troublesome sinuses, but a greatly increased liability to recurrence of the hernia?

It was Halsted himself, writing in 1893, who said, "The

use of powerful sewing materials in surgery is, it seems to me, based on a misapprehension of pathology. If, for example, the tension is so great that wire must be used to bring the parts together, one must not expect permanent assistance from the wire, for the stitches will eventually cut through to the extent necessary to relieve the tension." With this earlier opinion we most thoroughly agree.

Having shown that chromicized catgut or tendon may be rendered perfectly sterile, and that they may remain unabsorbed sufficiently long to fulfil all the requirements of a buried suture, without the danger of causing sinus formation, it remains for those who still use silk, silver wire, or silkworm gut to give some new and better reasons why they should not be abandoned.

To return to the technique of the operation itself, I have always believed the cutting of the internal oblique muscle not only unnecessary, but likely to weaken the canal.

In support of this view I would cite the results of two recent investigators in the anatomy of inguinal hernia, Turk, of Chicago, and Blake, of New York.

Turk made careful dissections of the inguinal canal in fifty cadavers, of which twenty-seven were males, nine adult females, and the remainder children or specimens of fœtal life. Turk's results prove that the internal ring derives its greatest protection from the internal oblique muscle. The average length of the origin of the internal oblique in the female was 9.3 centimetres, that is, the muscle arises on an average from the outer four-fifths of the ligament, while in the male it arises from the outer two-thirds. This greater length of the muscular origin would account in some measure for the relative infrequency of inguinal hernia in the female. Turk concludes that " the basis of the operation for the radical cure of oblique inguinal hernia should be to restore the internal ring to its normal size and position; second, to suture the internal oblique and transversalis muscles to Poupart's ligament." Turk does not believe in transplanting the cord.

Blake, of New York, in a paper recently read before the

Surgical Section of the Academy, reported the results of a series of careful dissections of the inguinal canal made upon twenty-five well-developed muscular subjects. He found that in no case did the insertion of the lower fibres of internal oblique and transversalis extend for more than five-eighths of an inch laterally to the insertion of the rectus; in the majority the extent was less than one-half an inch, and in some the insertion laterally to the rectus was inappreciable, and this insertion was almost wholly formed from the internal oblique. He states that our main reliance in the cure of inguinal hernia is the internal oblique muscle, and our effort should be to restore the normal parallelism of its fibres to Poupart's ligament.

In regard to Halsted's method of cutting the internal oblique, Blake says the most serious objection to this division is that the nerve supply of these fibres is divided laterally, hence the mesial portion of many of the divided fibres are deprived of that supply, and must consequently suffer. Blake calls attention to a second objection which has been overlooked by most writers, that is, that the divided ends of the muscle of the internal oblique are not re-united in their normal relation, but the proximal ends of the distal fibres are slid downward and inward to be sutured to Poupart's ligament. Blake says that it is the change of normal direction which prevents the muscle fibres from working so advantageously as if their parallelism with Poupart's ligament had been maintained.

In regard to results of operation in inguinal hernia in the female, as I have already said, few statistics are available. Bloodgood's report (*loc. cit.*) of operations of 459 cases of hernia at the Johns Hopkins Hospital contains a list of thirty-nine cases, with detailed results. The round ligament was excised in twenty cases, and the internal oblique muscle divided and transplanted (drawn down to the line of the wound). In six cases the ligament was excised, but the muscle not divided. In three cases the round ligament was not disturbed, but the internal oblique muscle was divided and transplanted. In five cases the round ligament was left undisturbed, and there was no division of the internal oblique muscle. In two cases the

round ligament was transplanted at the upper angle of the divided internal oblique muscle in the same manner as the cord is transplanted in the male (Halsted's operation).

In regard to results, death occurred in one case, recurrence in one case. Perfect results were noted in twenty-one cases. Six cases have remained well for three to eight years; three cases, two years, and nine cases one year.

My personal results are as follows:

From 1892 to the present date, I have operated upon 123 cases of inguinal hernia in the female without mortality.[1]

The ages of the patients have ranged between four and seventy years. Seventy-three patients were under fourteen years of age, and fifty cases between fourteen and seventy years. In eight cases, or 6.5 per cent., suppuration occurred; though in every case it was slight and limited to stitch-hole infection, not prolonging the stay in the hospital.

The average time I have kept patients in bed has been ten days, and they have been allowed to go home at the end of two weeks. A spica bandage is kept on for two weeks longer, at the end of which time support of any kind is discontinued.

I have been able to trace all but thirteen patients.

1 was well 7 years after operation; 2 were well 5 to 6 years after operation; 5 were well 4 to 5 years after operation; 14 were well 3 to 4 years after operation; 26 were well 2 to 3 years after operation; 27 were well 1 to 2 years after operation; 16 were well 6 months to 1 year after operation.

Two died one and two years after operation without recurrence. Thirteen were not traced, and the remainder are too recent to be considered. Not a single relapse has been observed. Comparing these results with the results of operations for inguinal hernia in the male, we see that the prognosis is even better in the female, and that the prospect of a cure may be reasonably assured.

[My own results show six relapses in 545 cases of inguinal hernia in the male operated upon by Bassini's method.]

[1] Including the cases up to October 1, 1900, this number has been increased to 134.

ECHINOCOCCUS CYST OF THE LIVER.[1]

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During the past few years it has been my good fortune to have been able to study five cases of echinococcus of the liver, occurring in the clinic of Professor Fowler. The following history is that of a case referred to me by Drs. Accetta, Desante, and Vermeglia, January 24, 1900.

The patient, twenty-eight years of age, an Italian, had spent the first twenty-five years of her life in Italy, coming to this country about three years ago. Since childhood she had suffered from frequent micturition, with at times the passage of large quantities of urine. One year before I saw her, she had had a miscarriage at three months, from which she suffered no after effects. With this exception she had enjoyed perfect health up to within three months of the time I saw her. At that time she had noticed a gradually increasing dragging pain in the left loin. Soon afterwards she discovered a tumor in the region of the umbilicus. This was tender and movable. It did not increase in size, but the dragging pains, which were not constant at first, became almost continuous and much more severe. There was nothing in the history to guide in establishing a diagnosis. The physical signs alone were to be depended upon. Bimanual examination disclosed that the tumor had absolutely no connection with the uterus or appendages. It could, however, be moved to any part

[1] Read before the April meeting of the Brooklyn Surgical Society, 1900.

of the abdominal cavity. Percussion revealed that the liver was of the normal size and normally situated. The colon could be traced throughout its entire course, the only peculiarity being that the transverse portions seemed a little higher than normal. There was no abnormal dulness over any part of the abdomen. The spleen could not be made out. The right kidney was larger than normal and normally situated. The left kidney could not be palpated in any position of the body. The tumor was of the size of two fists. Over it lay the transverse colon. It was smooth in its lower part, elastic to the feel, in its upper part solid. It felt and acted like a floating cystic kidney. Malignant disease was ruled out, as there was no loss of weight or strength, as one would expect with a malignant tumor of such proportions. The tumor could not be traced to the liver in the neighborhood of the gall-bladder; in addition, the tumor was not pear-shaped, nor had there been any symptoms of jaundice or gall-bladder disease. The tumor did not perceptibly move with respiration. Moreover, the colon overlay the tumor. It was noted, however, that the colon moved with the tumor. The provisional diagnosis of floating cystic kidney was made. The diagnosis was founded on the following facts: the tumor did not move with respiration; it was of the size and shape of a cystic kidney; the colon was in front of it; it was freely movable to all parts of the abdominal cavity, and the left kidney could not be palpated in any position of the body. Nevertheless, I was doubtful of my diagnosis, and advised laparotomy, so that, in case the tumor should not be a kidney, the operation need not be prolonged. I might say that, previous to my examination, another consultant had diagnosed the case as one of cystoma of the ovary.

The case was admitted to the Brooklyn Hospital, service of Dr. George R. Fowler, January 26, and operated upon by me January 27. A four-inch median incision was carried through the abdominal wall and the peritoneal cavity opened. The colon presented in the incision. This was pushed downward, exposing the tumor and also the left lobe of the liver. The case was plainly one of echinococcus cyst of the under surface of the left lobe of the liver, which by its weight had dragged the left lobe downward, causing the condition known as partial floating liver. The lower rounded portion of the cyst had become adherent to the anterior layer of the lesser omentum, and had adhered to this

and to the colon in such a manner as to cause the colon to overlie it. The cyst was separated from the colon and anterior layer of the lesser omentum, and was then easily delivered through the abdominal wound, which was enlarged for the purpose. The extent to which the cyst was attached to the liver was approximately six inches by two inches. The case was a suitable one for hepatectomy. The liver substance was incised with the thermocautery, and the cyst removed entire without rupturing. There was but one point on the liver surface, which bled rather profusely. That was in the neighborhood of the transverse fissure, probably one of the larger branches of the portal vein. A circumsuture sufficed to arrest the hæmorrhage at this point. The liver was gently replaced and a strip of iodoform gauze packed against the cauterized surface. It was noted that the liver was hyperæmic and quite friable. The round ligament was shortened and stitched to the abdominal wall with formic catgut, thus fixing the liver in its proper position. Gauze was packed between the liver and the diaphragm to produce adhesions, and thus aid in the support of the organ. The wound was closed, except at the upper angle, at which the ends of the gauze strips emerged. Half the packing was removed on the second day, the remainder one day later. The first few dressings were bile-stained, but this soon ceased. Final recovery was uneventful. At the present time, six months after the operation, the patient is in perfect health.

Historical Data.—The most scholarly article upon hydatid cysts that I have read appears in "A Clinical Treatise on Diseases of the Liver," by Dr. Fried. Theod. Frerichs, Professor of Clinical Medicine in the University of Berlin. A translation of this work by Charles Murchison, of London, was published in 1879. Though written twenty-odd years ago, this treatise stands to-day a model of painstaking care and accuracy, and might well serve to stimulate the student of to-day in making more thorough his researches along special lines. Hippocrates, Galen, and Aretæus mention the occurrence of large cysts of the liver filled with water, so that this condition was evidently familiar to ancient physicians. But it remained for the anatomists of the sixteenth and seventeenth centuries to accurately describe these cysts. We have

records of careful observations of these cases by Felix Plater, Vega, and Riverius. In the "Sepulchretum" of Bonetus there are several well described cases. Up to 1760 the cysts were supposed to be enlargements of the lymphatics, and their peculiar nature remained unknown. Finally, Palbas proved them to be independent parasites, and showed their close relation to the tapeworm. This was subsequently confirmed by Goeze. The first accurate descriptions of the echinococcus occurring in the human body was published by Bremser in 1821. From 1860, the year in which Davaine published his excellent work, to the present time, there have been numerous cases reported in detail, until now it would seem that the pathology and treatment of this interesting disease were established, and it only remained for us to so increase our diagnostic skill that the lesion might invariably be recognized.

The *exciting cause* in the production of an echinococcus cyst is the *tænia echinococcus*. This parasite has its habitat in the upper portion of the small intestine of dogs. In its mature condition, the worm is from four to five millimetres in length. The head is 0.3 millimetre in diameter. There are two rows of hooklets around the rostellum. There are three or four proglottides, the last being the largest. Introduced into the intestinal canal of man, the ova undergo partial development, and may be carried to distant parts of the body. The manner in which this occurs is as follows,—digestion destroys the covering of the ova, and its contained scolices are liberated, burrow in the intestinal wall, and thus enter the circulation. Should they, as is commonly the case, enter a radicle of the portal vein, they are carried to the liver. Here, or in other tissues, cysts are formed in the immature or cysticercus stage (Prudden), and are known as hydatids. Owing to the inflammatory reaction set up in the parts in which the cyst is lodged, a protective connective-tissue encapsulation is finally effected. The cyst wall proper consists of two layers,—an outer, laminated layer, the cuticle, and an inner muscular and vascular, designated as the parenchymatous layer. Within the primary or parent cyst are generally found secondary or daughter cysts,

and within these, again, other cysts may develop. The heads or scolices of the parasite are formed on the inner surface of the cysts. These develop in the pediculated vesicles called brood capsules (Prudden), the walls of which are similar in structure to the primary cysts. Several scolices may be formed in each brood capsule. They are similar to the head of the adult parasite, having a double row of hooklets surrounding the rostellum and four sucking discs. There is a pedicle on the posterior end of the scolex, marking the site of its attachment to the wall of the vesicle. Small, laminated concretions of lime salts are often present in the scolex. The scolices may be found free in the brood capsule, or, should these rupture, they are found free in the cysts. The hooklets, on the death of the scolices, may be embedded in the granular mass formed by the degeneration of the latter, or may be free in the brood capsule or in the cavities of the cysts. It may happen that neither brood capsules nor scolices develop in the cysts. Such cysts are known as sterile cysts. The cysts contain a clear gelatinous fluid which may be present in large or small amounts, or may be almost absent from the primary cysts. It is the presence or absence of fluid in the primary cyst which causes the variations in the so-called hydatid fremitus. The reaction of the fluid is, as a rule, neutral; rarely it is alkaline, and more rarely still, acid (Lueke). The specific gravity varies from 1.007 to 1.015. Albumen is absent. Succinic acid may be present, but is not constant. Grape sugar, leucin, inosite, and sodium chloride have been found in the fluid. Disintegration of the scolices may render the fluid turbid, or it may contain fatty detritus, cholesterin crystals, or lime salts. The fluid may be partially absorbed, leaving a thick grumous material within the cysts, which may become calcified.

Boinet, in April, 1894, reported his results in experimentation with the fluid from hydatid cysts. From this fluid he extracted a ptomaine, of which three-sixty-fourths of a grain injected under the skin of a mouse caused death in five minutes; seven-eighths of a grain injected into the veins of a rabbit gave rise to symptoms of hydatid intoxication, convul-

sions; first, accelerated and then retarded respiration, rapid action of the heart, dilatation of the pupil, collapse, and a reduction of temperature to about 80° F. Death was preceded by a few convulsive attacks. A patient with hydatid disease of the liver succumbed with symptoms of rapid respiration, and convulsions followed by paresis of the lower extremities, symptoms very similar to those observed in the animals experimented upon. This toxin is found more abundantly in cases in which puncture and electrolysis have modified the vitality of the hydatids; transforming the clear fluid into a yellowish, turbid, syrupy liquid rich in albuminoid matters. It resembles the mytilotoxin of mussels, and results from the reduplication of albuminoid matters. This ptomaine seems to exercise a toxic action upon the still intact hydatid vesicles, causing their aseptic necrosis and death.

The fully developed cyst is comparatively easy of macroscopic diagnosis. There is the connective-tissue capsule, the primary, secondary, and sometimes tertiary cysts, and the characteristic fluid. In cysts which have not degenerated, the microscope will show the scolices entire.

In cysts, the seat of degenerative changes, hooklets or portions of hooklets will be found in the detritus and also portions of the characteristic cyst membrane. In cysts which have become calcified there may be nothing to show the origin of the cyst. Prudden mentions two rare forms which the cysts may present. In the first the secondary vesicles are formed on the outside of the primary cysts. The name given to this variety is the echinococcus scoleciparіens or exogena. It is rare in man. The second variety, the echinococcus multilocularis, is more common. It is almost always found in the liver. It seems to be the result of disturbances in the development of the cysts. There are a series of irregular sized cysts surrounded by broad and narrow bands of connective tissue. These contain gelatinous fluid and a few scolices or hooklets, the latter difficult of detection. The entire mass is encapsulated, and may present an alveolar appearance. For this reason it was formerly regarded as alveolar carcinoma.

In order to preserve the cysts in as nearly a natural state as possible, Prudden recommends that the specimen be placed at first in a 5-per-cent. aqueous solution of chloral hydrate. After remaining in this solution for a week the cyst is immersed for permanent preservation in a 10-per-cent. solution of the same drug. A saturated aqueous solution of chloroform acts almost as well.

The *contributing cause,* as intimated above, is close companionship with dogs and in persons of uncleanly habits. The parasite is most frequently found in the upper part of the small intestine. It is also present in the intestine of wolves and jackals. The ova of the parasite are evacuated with the fæces, and may be taken into the human body through the medium of polluted drinking water. This mode of infection is probably not common. Much more likely the ova are introduced through handling or caressing dogs or coming into intimate contact with them. The ova may be conveyed by dogs licking the individual's hand or face. Iceland is the locality where the parasite attacks man most frequently, as in that country a close companionship exists between the inhabitants and their dogs. It is perhaps worthy of note, that not a single case of the multilocular variety has been noticed in Iceland. This variety is indeed rare. Bauemler, 1878, collected thirty-seven cases, and perhaps half as many more have been reported since that time. Next to Iceland, the disease occurs most frequently in Australia. The disease is seldom met with in France and Germany. In Russia it is very rare. An Italian physician tells me that the disease is quite common in Italy. This is borne out by my own experience, as the patients in whom I have observed the disease were all Italians. In England the disease is rarely met with outside of London. In the United States the disease is quite rare.

Symptoms.—These are due to pressure effects. Usually the first symptoms noted is the presence of a tumor in the liver region. Or there may be first noticed more or less discomfort or dragging pain in the epigastrium. Should the growth be situated upon the superior surface of the liver, that organ will

be pushed downward, so that its anterior edge may even reach the level of the umbilicus. The tumor in such a case will press upon the diaphragm and may cause some discomfort in breathing. Either the right or the left lobe may be the seat of the disease, which may be on the surface of the liver or entirely within its structure. Those cysts which are posteriorly placed are the most difficult of detection. Most frequently the tumor will be found springing from the inferior surface of the liver. In the case of the right lobe the mobility of the liver will probably not be increased; but if the left lobe is involved, the weight of the tumor will drag down that lobe, and it may well be that the tumor can be moved to almost any part of the abdominal cavity. Pressure on neighboring viscera may result in symptoms referable to those viscera. There may result interference with the action of the heart or lungs. The vena cava may be pressed upon, causing œdema of the lower extremities. Pressure on the bile passages may cause jaundice. Ascites may be caused by pressure on the portal vein. The tumor is firmly elastic and dull on percussion. Its surface is smooth and rounded. Its connection with the liver is usually readily made out.

Hydatid fremitus is due to the impulse of the daughter cysts upon one another in the absence of liquid in the parent sac. When the parent sac contains fluid, the daughter cysts swim, and do not yield the tremor (Tillaux).

Santoni, in 1894, found that the stethoscope (by auscultatory percussion) reveals a special and peculiar sound of sonorous quality having a low tone and of brief duration, which ceases abruptly. It may be compared to the sound produced by striking a membrane stretched upon a metallic frame. This sound is so characteristic, that once heard it can scarcely be forgotten. He considers it a pathognomonic sign of the disease.

Thomas Fiaschi, of Sydney, 1895, considers Santoni's resounding or booming sign as a valuable addition to the semeiology of hydatid disease. A fourth practical application of the test, not mentioned by Santoni, is the diagnosis of

single from multiple cysts, the sound being uniform in a single cyst, no matter on what part of the tumor percussion is made; while in multiple cysts there is a variation of the hydatid resonance dependent upon the number of cysts and the point percussed.

Termination.—The disease untreated may progress indefinitely, and death may occur from intercurrent disease, or a spontaneous cure may be effected, or death may ensue in a variety of ways. Spontaneous cure may be effected in three ways. The parasites may die and the sac subsequently contract. A communication may be effected with the biliary apparatus, and the entrance of bile into the sac may kill the parasite (in some instances, however, the parasite may survive). The more usual manner of spontaneous cure is effected by rupture of the sac into one of the neighboring viscera, stomach, intestine, lung, or pleura. In case of the latter two, however, the chances are against a favorable result. In rare instances, rupture may occur externally. Rupture into the stomach will be shown by the vomited cysts. Some may also pass per rectum. In rupture into the intestine, the cysts will be passed per rectum. When rupture takes place into the lung the fluid and cysts will be coughed up.

Duration of the Disease.—The growth of hydatid cysts is slow, as a rule, though cases are on record in which rapid growth has supervened for a time. In some instances the existence of the disease has not been suspected, and has only been discovered in the course of a post-mortem. It may exist for years before it is recognized. Barrier (Paris, 1840) analyzed twenty cases in reference to the duration of the cysts in the liver. In three of these, the disease had lasted for two years; in eight, it had been present from two to four years; in four, from four to six years; in the remaining cases, fifteen, eighteen, twenty, and even thirty years. One case coming under Frerich's observation had suffered from the disease for seven years, others from periods varying from two to three years. Of the cases which have come under our own observation, in one the disease had given symptoms for three months; in the

second, two years; in the third, three years; in the fourth, one year; in a fifth case I am unable to state the time.

Treatment.—In the past, various operative procedures have been employed. The use of caustics to promote adhesions between the sac and the abdominal parietes belongs to the pre-aseptic days of surgery. Tapping either with or without the introduction of solutions calculated to kill the parasite in the absence of adhesions, in such a thick fibrous sac wall, is dangerous both from the suppurative changes which may ensue in the sac and the possibility of the escape of sac contents into the peritoneal cavity. Modern treatment consists in the stitching of the sac wall to the edges of a wound in the abdominal parietes and then incising it, either in one or two stages. In certain cases the cyst may best be reached by the transpleural route or through the lumbar region. The tension of the sac may be lessened by aspiration of a portion of its contents.

It is essential to success that none of the fluid be allowed to escape into the peritoneal cavity. Subsequent to incision, the lining membrane of the sac is pealed off as completely as possible. A stream of warm solution directed between the lining and the fibrous capsule will greatly facilitate this. The cavity is irrigated and packed daily until only a small sinus is left. This, as a rule, does not close readily. Finally, there remains a shrivelled-up mass of fibrous tissue attached to the liver. This healing process may take many months, and require constant attention. A liver fistula may persist indefinitely.

Because of the long period during which the cases drained are kept from active work, it is desirable in those cases which admit of the procedure being carried out with a fair chance of success, that a hepatectomy be performed in order to totally eradicate the disease. Cysts which are not very large, or where a comparatively small amount of liver tissue is involved, may be subjected to this procedure. Great care must be exercised in selecting such cases.

Palleroni (*Gazz. degli Osped.*, August 7, 1898) advocates the employment of a provisional ligature passed through the

entire thickness of the liver in order to maintain that organ in the abdominal wound while the hepatectomy is in progress. Terrillon, of Paris, used an elastic ligature around the portion of liver affected by a number of small hydatid cysts. The portion of liver thus encased was fastened into the abdominal wound. The elastic pressure caused gangrene, and the diseased portion, the size of two fists, separated as a slough. Burns successfully removed a multilocular cyst. Tansani dissected a cyst from the liver substance and sutured the resulting gap. This has also been done by Bergmann, Küster, and Eiselsberg. In 1893, C. Mansell-Moulin and Billroth each performed hepatectomy for this disease. In 1890, Rozzi, of Italy, removed two inches of liver substance with a cyst attached. In 1889, Loretta, of Bologna, excised the affected portion of liver. Bozzi in the same year reported a successful case of excision. In 1888, Landau reported three cases. In addition to these cases there are but few which have been treated by excision. Since writing the above, I have assisted Professor Fowler in the removal of a large single echinococcus cyst of the left lobe of the liver. The details of this case will be reported at a later date.

A COMPLETE SERIES OF CLINICAL CHARTS FOR KEEPING THE RECORDS OF SURGICAL CASES.

By CHARLES H. FRAZIER, M.D.,

OF PHILADELPHIA,

ASSISTANT SURGEON TO THE UNIVERSITY HOSPITAL; SURGEON TO THE PHILADELPHIA AND HOWARD HOSPITALS.

THOSE who are compiling statistics or making inquiry into particular phases of certain subjects know how tedious and time-consuming a task it is to sift out the data that bear directly upon the subject of the investigation. If these facts were arranged and classified in a systematic manner, their task would be immensely lightened. With this idea in view, I have compiled five clinical charts, which are used in the surgical service of the University Hospital: (1) a History and Treatment Record; (2) an Anæsthesia Record; (3) a Nurse's Record; (4) a Temperature Record; (5) a Pathological, Bacteriological, Blood, and Urine Record.

These Record Sheets are of the same dimensions and have each a margin of the same width, in order that they may be bound together. Two of the five have been so designed that the records may be written upon both sides of the sheet, not so much for the sake of economizing in paper, but more particularly for the sake of economizing in space and condensing the matter into the fewest number of pages. On the heading of every sheet space is provided for the patient's name, the index file number, and the number of the volume in which this particular history will be found.

(1) *History and Treatment Record.*—At the top of the sheet space is allowed for the filling in of a number of data that will be frequently referred to, and which, if not isolated, must

be tediously searched for in the text of the history. Thus, the age and address of the patient, the age and address of the physician by whom the patient was referred, the diagnosis, the character and date of the operation, the character of ligature or of suture material used, the introduction and withdrawal of

HISTORY AND TREATMENT RECORD.

NAME Mr. J.G.Z. HOSPITAL University INDEX FILE NO. 335 VOL. III

Age 19 Address University Dormitories Service of Dr. Frazier

Date of Admission July 5, 1900 Date of Discharge

Referred by Dr Alfred Stengel Address 1811 Spruce St., Philadelphia.

Diagnosis Recurrent Appendicitis

Operation Appendectomy Date July 7, 1900.

Ligature Material Catgut Suture Material Buried- Catgut Drainage None
Cutaneous silk worm gut

Character of Dressing Sterile gauze and cotton

Drainage Removed Sutures Removed July 17, 1900 Freq. of Dressing Once a week.

Skiagraph No. Date Result

DATE	
7-7-00	The patient was transferred from the Medical to the Surgical Wards of the Hospital, having just recovered from his third attack of appendicitis. (For previous history, see records in Medical Ward.) Operation in the interval; McBurney's incision. Appendix delivered through the wound without any difficulty. Mesentery ligated. Appendix ligated close to caecum with silk ligature. Purse-string suture introduced into caecum around the base of the appendix; stump of the latter inverted and suture drawn fast. Peritoneum and transversalis fascia, the internal and external oblique muscles, closed with buried catgut sutures; skin and cellular tissue, with interrupted silkworm-gut sutures.
7-8	Patient was somewhat shocked after the operation and required some stimulation. This evening the abdomen is soft, and peristalsis is active. Complains of some little pain at seat of operation
7-9	One grain of calomel in divided doses, followed by Epsom salts, was ineffectual. Bowels moved freely after the administration of an enema.
7-14	Abdominal wound dressed today for the first time. Wound has healed throughout by first intention. one-half of the stitches were removed. Patient given soft diet.
7-17	Remaining stitches removed at second dressing today.
7-18	Patient complained today for the first time of pain over the femoral vein. Examination proved it to be due to a phlebitis. This accounts for the increase in leucocytes noted in blood-count of this date. Leg enveloped in lead-water and laudanum elevated and placed in fracture-box.

drainage, the frequency of subsequent dressings, and the date at which the sutures were removed, are given; finally, space is allowed for a record of the skiagraph, if one is taken.

Then follow the history and examination of the case, the subsequent ward notes, including a description of the

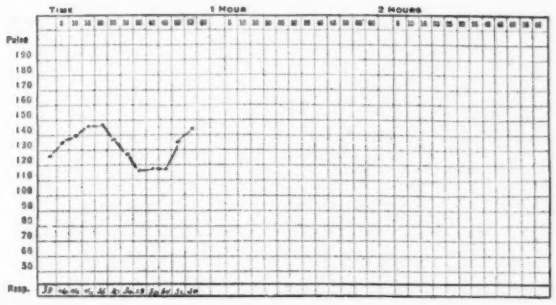
operation, which may be written up by the operator or the registrar. Both sides of the sheet are ruled, so that the history may be continued on the other side.

(2) *The Anæsthesia Chart* is modelled after the one in use in the Gynæcological Wards of the University Hospital in

ANESTHESIA AND OPERATION RECORD.

NAME Mr. J. G. Z. HOSPITAL University Hospital INDEX FILE NO. 335 VOL. III

ANESTHESIA CHART.



Operation Appendectomy Date July 7, 1900 Operator Dr. Frazier

Operation Started 1:10 P.M. Operation Ended 1:50 P.M.

Anesthetic

Variety Ether Method Allis inhaler Anesthetist Dr. Asher

Time to Anesthetize 10 minutes Amt. to Anesthetize 2 ounces Total Amt. Used 4 ozs.

Examination of Chest (before) Negative

" " " (after) "

Treatment on Table

Stimulatic Strychniae sulph. gr. 1/30 hypodermically.

Normal Saline Solution

Method of Introduction

Amount Introduced

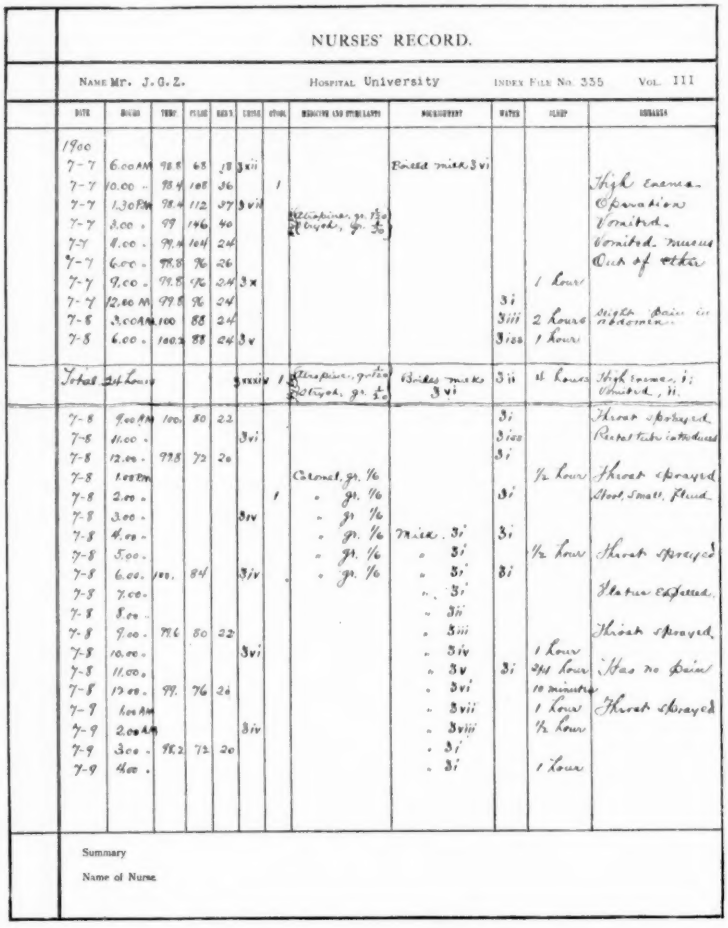
Oxygen

General condition of patient at time of operation Good.

REMARKS

the service of Dr. Clark. Apart from the valuable statistics upon anæsthesia which a large series of these charts furnish, they are of additional value in that they keep the attention of the anæsthetizer constantly on his patient. The pulse rate,

which is taken every five or ten minutes, is represented by a tracing upon the chart, while the rate of respiration is recorded in numerals at the foot. In addition to filling out the chart itself, it is the duty of the anæsthetizer to record other facts



NURSES' RECORD.

NAME Mr. J. G. Z. HOSPITAL University INDEX FILE NO. 335 VOL. III

DATE	HOUR	TEMP	PULSE	RESP.	LOSS	OTHER	MEDICINE AND STIMULANTS	NOURISHMENT	WATER	SLEEP	REMARKS
1900											
7-7	6.00 AM	98.8	68	18	3xii			Boiled milk 3vi			
7-7	10.00 "	98.4	108	36		1					High enema.
7-7	1.30 PM	98.4	112	37	3vii						Operation
7-7	3.00 "	99	146	40			Atropine, gr. 1/150 Strych, gr. 1/30				Vomited.
7-7	4.00 "	99.4	104	24							Vomited. nausea
7-7	6.00 "	98.8	96	26							Out of ether
7-7	9.00 "	99.8	96	24	3x					1 hour	
7-7	12.00 M	99.8	96	24					3i		
7-8	3.00 AM	100	88	24					3iii	2 hours	slight pain in abdomen.
7-8	6.00 "	100.2	88	24	3v				3iss	1 hour	
Total	24 hours				3xxiv	1	Atropine, gr. 1/150 Strych, gr. 1/30	Broken meals 3vi	3ii	11 hours	High enema, 1; Vomited, 11.
7-8	9.00 PM	100.	80	22					3i		Throat sprayed.
7-8	11.00 "				3vi				3iss		Rectal tube introduced
7-8	12.00 "	99.8	72	20					3i		
7-8	1.00 PM						Cramol, gr. 1/6			1/2 hour	Throat sprayed
7-8	2.00 "					1	" gr. 1/6		3i		Throat, mouth, throat
7-8	3.00 "				3iv		" gr. 1/6				
7-8	4.00 "						" gr. 1/6	Milk 3i	3i		
7-8	5.00 "						" gr. 1/6	" 3i		1/2 hour	Throat sprayed
7-8	6.00 "	100.	84		3iv		" gr. 1/6	" 3i	3i		
7-8	7.00 "							" 3i			Vomiting started.
7-8	8.00 "							" 3ii			
7-8	9.00 "	99.6	80	22				" 3iii			Throat sprayed.
7-8	10.00 "				3vi			" 3iv		1 hour	
7-8	11.00 "							" 3v	3i	2½ hour	Has no pain
7-8	12.00 "	99.	76	24				" 3vi		10 minutes	
7-9	1.00 AM							" 3vii		1 hour	Throat sprayed
7-9	2.00 AM				3iv			" 3viii		½ hour	
7-9	3.00 "	98.2	72	20				" 3i			
7-9	4.00 "							" 3i		1 hour	

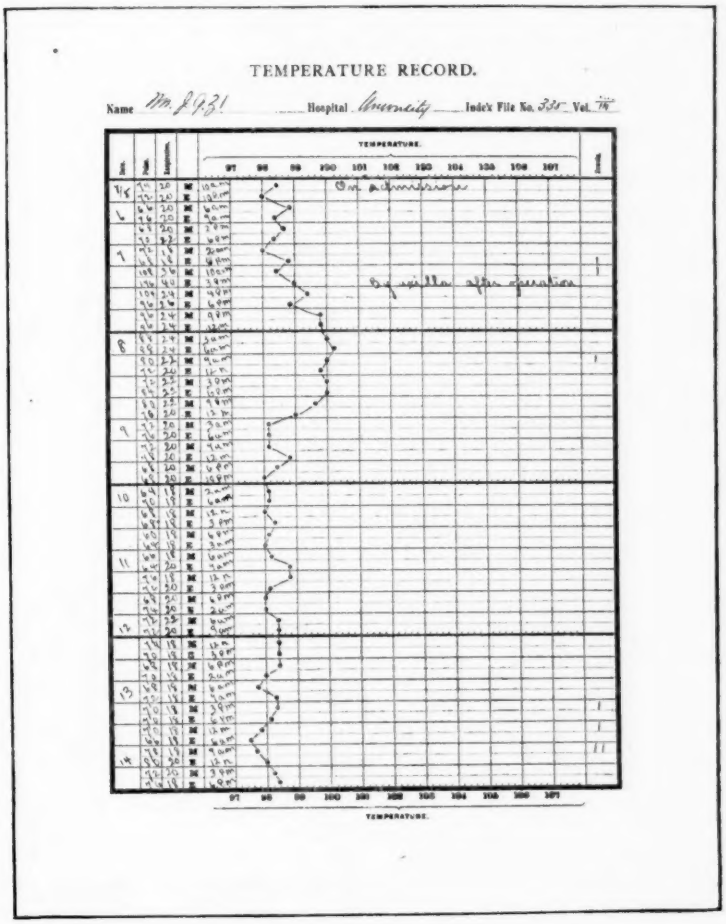
Summary

Name of Nurse

relative to the condition of the patient before, during, and after the operation; the duration of the operation; the time and the amount of anæsthetic required to fully anæsthetize the patient, and the total amount used; the treatment, if any,

carried out upon the table (*e.g.*, hypodermic, stimulating, the use of normal saline solution, inhalation of oxygen, etc.).

(3) *The Nurse's Record* contains columns in which to record the temperature, pulse, and respiration; the urine and stools; medicine and stimulants; character and amount of


TEMPERATURE RECORD.

Name Wm. J. P. [illegible] Hospital University Index File No. 338 Vol. 14

nourishment, and the amount of water the patient has drunk. Provision is not usually made in clinical sheets for recording this information; and yet it is quite as important sometimes to know how much water the patient has drunk as it is to know how much he has eaten.

This record is kept only after major operations or after a serious injury, and is discontinued when the patient begins to convalesce, at which time data furnished by the temperature and history sheet will suffice. At the end of each twenty-four

BLOOD AND URINE RECORD.

Name Mr. J. G. Z. Hospital University Index File No. 335 Vol. III

Date	H.	Reds	White	Relative	Absolute	Changes in Reds	Sp. gr.	Remarks
7-7-00	89	5,420,000	13,120	P. 76.6 L. 15.2 M. 1.4 T. 6.4 E. .4	10,050 1,994 184 840 52	Normal		Just before operation, 1.30 P.M.
7-8-00	90	5,810,000	20,320	P. 82.2 L. 7.4 M. 2.2 T. 8.2 E. 0.0	16,703 1,504 447	Normal		Just out of ether, 3.15 P.M.
7-10-00	87	5,570,000	16,000	P. 65.7 L. 21. M. 2.5 T. 9.6 E. 1.6	10,512 3,360 400 1,536 192	Normal		Count taken at 5 P.M.
7-12-00	81	5,750,000	15,280	P. 72.6 L. 14.8 M. 2.4 T. 8.6 E. 1.6	11,093 2,262 367 1,314 244	Normal		Count taken at 5.15 P.M. Patient very comfortable.
7-13-00	86	5,870,000	12,160	P. 68.2 L. 21.8 M. 1.0 T. 6.4 E. 2.6	8,923 2,651 122 778 316	Normal		Not dressed since operation. Count taken at 5.30 P.M.
7-18-00	84	5,770,000	15,840	P. 73.75 L. 19.25 M. .75 T. 4.50 E. 1.75	11,682 3,049 119 713 277	Normal		Count taken at 5.30 P.M. Not dressed since 7-14-00. No pain at wound. Complains of pain in leg.

URINALYSIS

Date	Characteristic	Sediment	Sp. gr.	Reaction	Sugar	Albumen	Amt. in 24 hrs.	Urea	Total Solids		Microscopic Examination
7-7-00	Light Amber	Slight	1023	Acid	None	None					Uric acid crystals.

hours the nurse in charge of the case makes a summary, which includes the maximum and minimum pulse, respiration and temperature; the total amount of stimulation, nourishment, water, sleep, urine, and the total number of stools. Thus, at a glance, the attending surgeon is apprised of the behavior

and condition of his case during the past twenty-four hours, and can make, if he so chooses, without any difficulty, a comparison of the condition of one day with that of another.

(4) *The Temperature Record* is one which has been in

PATHOLOGICAL RECORD.

Name Mr. J. G. Z. Hospital University Index File No. 335 Vol.

Specimen of an appendix with little or no mesenteric attachment.

Pathological Diagnosis Chronic Interstitial Appendicitis.

Microscopic Description The appendix measures three and one quarter centimetres in length; .5 centimetres in diameter at its proximal portion, and .9 centimetres at its distal portion. The walls of the appendix are thicker and more resistant than normal and feel somewhat indurated. The lumen is filled with an exudate which is mucopurulent in character. The blood-vessels are markedly distended, especially in the distal portion.

Microscopic Description The section taken for examination is from the proximal end. The mucosa, submucosa, muscularis and serosa all give evidence of previous inflammatory disturbance. All the coats especially the serous are thicker than normal. There are several hemorrhagic areas in the mucosa and submucosa and immediately beneath the serous coat. The epithelial lining of the mucosa and the glandular elements has almost entirely disappeared. Connective tissue is present to some extent in all the layers. The mucosa and submucosa are the seat of a very active infiltration of round cells and at one or two places small interstitial abscesses have formed. The blood-vessels are dilated and their walls considerably thickened.

BACTERIOLOGICAL RECORD.

Specimen of mucopurulent secretion from cavity of appendix.

Bacteriological examination gave pure cultures of Bacillus pyocyaneus.

use in the Surgical Service of the University Hospital for some time, and calls for no especial comment.

(5) Upon one side of the last sheet is entered the *Pathological and Bacteriological Report* upon its receipt from the laboratory of the pathologist or bacteriologist to whom the

specimen has been referred. The frequency with which one finds himself turning to one or the other of these laboratories for information warrants the reservation of at least one page for these reports. The undoubted value of the blood count in the diagnosis of surgical affections makes it almost imperative that one should take advantage of the information to be gathered from this source. A table has therefore been included in which a dozen or more blood counts may be entered. A urinalysis table concludes the series.

RESULT OF OPERATION FOR CANCER OF PENIS.

By NATHAN RAW, M.D.,

OF LIVERPOOL,

MEDICAL SUPERINTENDENT MILL ROAD INFIRMARY.

Peter S., aged thirty-nine, was admitted into the Mill Road Infirmary on July 11, 1899, under my care suffering from extensive cancer of the penis and scrotum. He is a strong, muscular man, but much wasted. He states he has never been able to completely draw back his prepuce. Has never had any venereal disease. Twelve months ago he noticed a small warty growth on the tip of his glans, which slowly enlarged and spread up the body of his penis; it has grown rapidly during the last three months.

On examination, the whole of the penis seems to be replaced by a large, warty, irregular ulcerating growth, which has extended to the pubes and downward on to the centre of the scrotum. (Fig. 1.) The edges are hard and indurated, and the base is irregular and covered with grayish granulations which bleed readily. The edges are everted. From the surface of the growth exudes a clear, sanious, offensive discharge. The glands in the right inguinal region are enlarged and very tender. He has no control over his urine, which simply trickles constantly over this ulcerating surface.

Operation, August 14, 1899.—The urethra was first of all exposed as far back in the perineum as possible and divided, the proximal end being stitched to the skin by four silk sutures.

Incisions were then made in both inguinal regions and through the skin, completely encircling the root of the penis down to the pubic arch. The spermatic cords were then both divided, and the whole of the penis and scrotum removed "en masse" with the exception of the skin of the lower quadrant of the scrotum, which was healthy. It was found that although the penis was removed at the level of the abdomen, it was still cancerous;

consequently, a deeper dissection was made and each crus was detached from its corresponding pubic ramus and cut off. Everything then appeared to be healthy; the bleeding was easily controlled, and the skin of the lower part of the scrotum was drawn up and united to the abdominal skin. A soft catheter was passed through the new opening into the bladder and the wound accurately sewn up with silk sutures. The operation lasted forty minutes, and the patient rallied well.

The wound healed by first intention; he passed urine through the catheter for twenty-four hours, when it was removed, and he afterwards passed it voluntarily and with complete control of his bladder.

He left the hospital a month afterwards quite recovered and with complete control of his urine.

April 12, 1900.—He was inspected to-day, eight months after operation; there is no sign of recurrence (Fig. 2); he has gained four stones in weight, and he is following his usual employment.

Microscopically, the growth was an epithelioma.

FRACTURE OF THE SPINE.[1]

By WALTER LATHROP, M.D.,

OF HAZLETON, PA.,

SUPERINTENDENT OF THE STATE HOSPITAL FOR INJURED PERSONS OF THE MIDDLE COAL FIELD OF PENNSYLVANIA.

In a region filled with mines, railroads, and shops, and where that form of mining known as "strippings" is the most common, we naturally see many injuries of the back, from concussion to fracture and dislocation. Of concussion, with its resulting paralysis, either temporary or sometimes prolonged, I shall say nothing, as it belongs more properly to those who are experts in medico-legal matters, and have to deal with it under the name of railway spine. From 1 to 3 per cent. of all fractures are those of the spine, and of these (according to Keen) 20 per cent. are dislocations, 20 per cent. are fractures, and 60 per cent. are fracture and dislocation.

Fracture of the dorsolumbar is most common owing to the fixed and rigid dorsal and the movable lumbar vertebræ.

My experience has been with fractures of the dorsolumbar region, and it is of such that I speak particularly. Without going into further details as to symptoms and diagnosis, for they are usually pretty definite (especially where the deformity is marked), I will confine myself to the treatment. There is a wide difference of opinion as to the best method of treating a condition which at the best is a very serious affair, and in which we have a high mortality. We have a patient who is already half dead; we have visions of

[1] Address in Surgery, State Medical Society of Pennsylvania, Session of 1900.

severe bed-sores, and a bad case of cystitis, and perhaps, later, pyelonephritis from a paralyzed bladder. This state of affairs, together with a paretic bowel, makes a picture that appeals to us all. What is the treatment best calculated to afford a chance for relief?

The first thing that suggests itself is the reposition of the fragments, and this can sometimes be done by the use of force—severe extension and counter-extension—under complete anæsthesia. This has been accomplished in some cases of fracture of the dorsal or lumbar region. After succeeding, the patient must still have extension continued, or a plaster jacket applied. A water- or air-bed is absolutely indicated. Any moving of the patient must be done with the greatest care, for the slightest twisting in the injured part may produce sudden and serious symptoms, if not death.

The urine must be watched and kept in the most aseptic condition possible, both by frequent and careful catheterizing and by irrigating the bladder.

I believe extension does little if any good, but can do a great amount of injury. A loose piece of bone, causing no trouble, may be forced by extension into the substance of the cord, and injure it beyond repair. Should extension remove or relieve a piece of bone already pressing on or embedded in the cord, it would be merely a case of good luck.

If a plaster jacket be applied after extension, it is certainly harmful, by its pressure upon the injured and paralyzed parts. In fact, I believe the results achieved by extension would have been the same had the patients been placed on air-beds and given perfect rest.

As to laminectomy, while the outlook in any case of fractured vertebræ is not encouraging, I firmly believe that where the paralysis is due to *pressure on the cord* from hæmorrhage, or a piece of bone, or a foreign body, we may look for relief by operation.

With the aid of the Röntgen rays, a change of opinion has taken place. With this valuable adjunct, the fracture can be definitely seen, and splinters of bone can be located, or

the bone pressing on the cord can be demonstrated with little trouble. In these cases of severe crushing injuries, and where we are almost certain that the cord is compressed or being injured by spiculæ of bone, operation is clearly indicated, and, to repeat what was just said, will often bring great relief, and sometimes permanently cure. To my mind nothing is more rational or natural than to remove a fragment or several fragments of bone that are pressing upon the cord. By the open treatment of these cases we can also remove any accumulations of blood, which are fertile sources of pressure and permanent paralysis. We do not hesitate to open the skull for a depressed fracture, or for paralysis, resulting from supposed rupture of the middle meningeal; and yet in the cord we have structures that are in most ways identical with the cranial contents; and why not do likewise for an injury similar in many respects, and no more dangerous to life?

The results obtained by various operators who have performed laminectomy for fractured spine have been encouraging. Experience has shown repeatedly that degeneration of the cord is rapid and progressive where pressure from bone, or other cause, is present and continuous. It has also been proven that the loss of blood during operation is not severe, nor does the escape of spinal fluid do any harm.

The back is not weakened by the loss of lamina and spinous processes. The number relieved certainly justifies operation. The upper half of the cord, when injured, offers little hope from operation, though benefit has been shown in reported cases by McCosh, Abbe, Munro, and Horsley.

Ordinary shock does not contraindicate operation, for the injury itself is producing the shock, laminectomy relieves the pressure, and consequently raises the body tone and helps restore the body heat. I believe all cases, if operated upon, should have it done within forty-eight hours, if not sooner, when the displacement is marked and diagnosis is almost a certainty. All open injuries of the cord call for active interference, for in these cases we may have infection, foreign bodies, or necrosis of the tissues; and operation permits care-

ful cleansing, removal of foreign particles, careful drainage, and possible ultimate recovery. Burrell (quoted from Keen) "has analyzed 168 cases of fractured spine, and has not only given up his earlier plan of forcing back the fragments, but advocates operation in all cases of fracture within the first twenty-four hours; including even those in the cervical region;" but I would certainly exclude the cervical from the list of operations promising any success.

The preparation for, and the technique of, the operation is important. The patient should be given strychnine freely some hours before, and hypodermics charged with the same should be in readiness for use during its performance.

He should be placed in a semiprone position; hot bottles and warm blankets should be used to keep up body heat and diminish shock. Great care should be observed in giving the anæsthetic, as the position of the patient, and the more or less abdominal paralysis, makes this a most trying procedure, and demands the service of a man who is experienced in administering anæsthetics.

In these cases, all means of reaching the cord rapidly and with safety should be considered; and by this I mean the rapid division of bony structures by strong, sharp rongeurs and forceps.

The greatest danger is *infection* and *sepsis,* which are almost invariably fatal. A free incision should be made down to the bony structure, and the tissues carefully dissected from each side in the manner recommended by Keen; or a horseshoe flap can be raised, either free or containing the spinous processes, and then the tissues freely separated. The neural arch is exposed, and the lamina severed by a cutting forceps, and further exposure of the canal is readily accomplished by rongeur or laminectomy pliers; usually, extravasated blood will be much in evidence, and continuous irrigation with normal salt solution should be practised.

In badly depressed fractures, the dura mater may be torn, and removal of fragments of bone will show at once the injured cord. If the dura is intact after removal of bone, it

should not be opened, unless there is evidence of blood beneath it. If torn, careful irrigation and exploration of canal and cord should be made, after which the dura may be closed by fine sutures, if practicable, and the whole wound closed tight; or, if drainage is used, it should be of one or two narrow strips of gauze.

The after-treatment is important. There will be considerable oozing, and this will necessitate a change of dressing in twenty-four hours; but after that the wound should not be disturbed oftener than every forty-eight hours, unless the indications point to infection and pus. It is needless to add that strict antisepsis must be observed during the dressing. Careful attention must be paid to the secretions, as they are a fertile source of infection.

The internal administration of strychnine is valuable; absolute quiet must be maintained for some weeks, after which the case will furnish its own indications.

Under antiseptic and aseptic methods the mortality after operation is said to be 60 per cent.; the cases benefited by operation, 25 per cent., and a cure may be expected in about 7 per cent. This percentage of cures should increase with earlier operations. I have had seven cases of undoubted fracture, with three deaths, three greatly benefited, and one cured. The following is a brief account of the last case operated on.

T. S., aged thirty-nine years, while at work in the mines at Hazle Brook, January 17, 1900, was caught by a fall of coal and completely buried beneath the mass. His brother, who worked with him, summoned help, and the coal was removed. The injured man was placed on a train and brought to the hospital in the evening, a few hours after the injury. Examination showed a multiple fracture of the left leg, severe contusion of entire body, and a distinct projection in the dorsolumbar region. Paralysis was absolute from the waist down. Shock was severe, and his general condition serious. He was placed in bed, and the usual preliminary treatment for such cases was given; the fractured leg being placed temporarily in a fracture-box. The next morning he was but little improved, the temperature being sub-

normal. The projection of the spine was very marked and freely movable. I determined to operate at once, and had him prepared and well stimulated. He was etherized and the seat of injury cut down upon. The fracture was indeed severe, the "laminectomy" consisting in merely dissecting away the muscular attachments, when the processes, lamina, and arch of the last dorsal and first lumbar were easily picked up. So severe was the crushing, the spinal canal was filled with blood, which was cleared by irrigation with salt solution; the end of the cord was partially torn; after thorough irrigation and the removal of several spiculæ of bone, I closed the wound completely without drainage. The patient was put on an air-bed and the fractured leg put up in plaster. Strychnine was administered from the start, alternating with iodide of potash. Improvement began in four weeks, and the man left the hospital walking with the aid of a cane in July.

At the present writing, August 10, I have under my care a man who was hurt on January 20 of this year, by being caught between a mine-car and a pillar of coal. He was stooping at the time, and was caught while in that position. On admission to hospital, it was found that he had no mark or injury save a decided projection in the dorsal region. Paralysis was absolute. Extension and manipulation were cautiously used, with no result. Operation was then advised and firmly refused. This advice was given repeatedly during the next two weeks, but without avail. He was soon in a pitiable state. He developed two enormous bed-sores, just now about healed. Severe cystitis, requiring daily irrigation, soon followed; at present of little trouble. Sloughing of both heels, marked œdema of thighs and legs, together with involuntary passage of the urine and fæces, made a case that was pitiable indeed; and at present he possesses a powerful frame only, covered by atrophied muscles, where a few months ago were 190 pounds of healthy flesh. He now asks for operation, but is not in a condition to warrant it at present. I believe, had he been operated upon shortly after being injured,

his chances for being benefited would have been most excellent.

I have had four other cases of fracture and dislocation of spine, all of them refusing operation, and remaining paralyzed now over two years, and are at present inmates of the poor-house, where they will *exist* perhaps for some years to come. Such as these are cases in which operation will certainly offer the best chances for relief, and without it they are doomed in all probability to a living death.

White's statistics show that thirty-seven operations, performed under strict antisepsis, gave six complete recoveries from operation and injury; six recoveries with benefit; eleven recoveries without benefit, and fourteen deaths. ("American Text-Book," Surgery.)

W. B. Lowman (personal communication) reports seven cases operated upon, with four deaths, two improved, and one with very marked benefit. He believes in the operation, and does it in every case when the patient consents.

Deaver (personal communication) believes the operation justifiable in certain cases. He has operated several times, but has seen little good come from the operation. He further says that it seems to offer the only hope in the majority of cases.

Laplace (quoted from McKenna) reports one operation for severe fracture of dorsal vertebræ, in which several fragments were removed. The result was very marked, and the patient improved rapidly.

Warren (*Boston Medical and Surgical Journal,* May, 1899) reports three cases, all recovered; one was a fibroma of cord; the others for injury.

Davis (*Western Medical Review*) reports one case of fracture. Laminectomy performed with great improvement.

Kramer (*Journal of the American Medical Association,* August, 1900) reports two cases; one in which a thirty-eight calibre bullet entered the abdomen and lodged in the body of the ninth dorsal vertebra, as shown by X-ray. Laminectomy was performed and the ball was removed. Patient succumbed to pyæmia four months later.

The second was a fracture and dislocation of the twelfth

dorsal and first lumbar. Operation three days after injury. Patient improved rapidly, and was able to walk with aid of cane in six months, and to work at his trade (cigar maker).

Munro (*Journal of the Medical Association,* January 6, 1900) reports seventeen cases; eleven died; one relieved for some months; two cured; two improved; one no improvement after eight months.

These operations were on cervical, dorsal, and lumbar vertebræ, and included chronic cases, and also sarcoma of the cord.

Mears (ANNALS OF SURGERY, 1899) reports one case of fracture of last dorsal and first lumbar. Laminectomy performed; recovery.

E. Noble Smith (*Lancet,* August 19, 1899) reports a case in which he operated four months after the injury. Cord was compressed by fragments. Bed-sores very extensive. Patient made a rapid recovery.

Scudder (personal communication) "heartily approves of the line of treatment (with the restrictions mentioned) as advocated in this paper." He further says ("Treatise on Fractures"), "Fracture of the arches of the vertebræ, whether open or closed, should be subjected to operation. Fracture and compression of the cauda equina after six weeks of waiting should be treated by operation."

W. L. Rodman (personal communication) reports three operations. One, in which a pistol-shot entered the eleventh dorsal vertebra, completely severing the cord, laminectomy was performed, but the patient was not benefited, as it was six months after the injury before the operation was done. The patient recovered as far as the laminectomy was concerned.

The second case was a boy of sixteen, who had fractured two dorsal vertebræ, and had extensive injury to membranes and cord. He was operated upon shortly after the injury, but succumbed two weeks later from myelitis and meningitis, due to the injury.

The third was a case in which the fracture was high up in the dorsal region. Paraplegia was complete. Operation was performed several months after the injury. The patient recovered and left the hospital very much improved. Rodman states that "when done early, before structural changes occur in the

spinal cord, there is every reason to hope for decided amelioration, if not perfect cure."

Dr. J. C. Biddle, of the State Hospital at Ashland, Pennsylvania, reports thirty cases of fracture dislocations; sixty-six of fractures; twenty-eight of dislocations; forty-eight of partial dislocations; 172 cases in all.

Of the thirty fracture dislocations, twenty-one, or 70 per cent., died, three were cured, five improved, and one unimproved. They were treated 2328 days.

Of the sixty-six fractures, thirty-five, or 53 1-33 per cent., died, seventeen cured, ten improved, and four unimproved. They were treated 6637 days.

Of the twenty-eight dislocations, seven, or 25 per cent., died, eleven cured, eight improved, and two unimproved. They were treated 4199 days.

Of the forty-eight partial dislocations, five, or 10 5-12 per cent., died, twenty-nine cured, twelve improved, and two unimproved. They were treated 4969 days.

Dr. Biddle operated on twenty-nine cases, some immediately, some within a few days, and some from a few weeks to three months after the injury. As he expresses it, he "selected only those cases that seemed hopeless without operation."

I believe he would have had a large number improved, had all been operated upon within forty-eight hours. Of the twenty-nine cases, eighteen died, nine improved, two cured. This gives 31 per cent. of improvement and 7 per cent. cured.

Roberts says ("Modern Surgery"), "Trephining, sawing or cutting away the arches of the vertebræ for the purpose of removing pressure on the spinal marrow, has been attended with some success, and should be adopted more frequently than has heretofore been the case. Operation is always justifiable if the fracture is definitely located, and there is no reason to suspect irrelievable displacement."

Golding Bird says, "The hope of restoration of function in those cases in which the cord is not irretrievably damaged depends on the promptitude with which the cause of compression is removed; and however small the number of cases may be in which benefit is to be looked for, even these few justify one in immediate operation."

Keen ("Dennis's Surgery") says, "In an accident, there-

fore, of such gravity, followed by such an immense percentage of deaths, if no operation be done, it would seem to be advisable, with our present experience in all suitable cases, to give patients the real, though often desperate, chance that operation affords; and that the operation should be done at a *much earlier* period and more thoroughly than has hitherto been the rule." (Italics mine.)

To summarize, I would say:

(1) In partial lesions we should operate.

(2) Where the lumbar region is involved with lesions of the cauda equina, operation offers the best chance for recovery.

(3) In fracture of the spinous process, lamina, or entire neural arch, *operation is demanded.*

(4) Should immediate operation not be done, and we wait six to eight weeks, with the result that paralysis of the bladder and bowel continues, with cystitis and severe bedsores present, we may be sure that nature cannot relieve the case, and an operation is not only indicated, *but demanded.*

[NOTE.—On August 22 I operated upon the case mentioned in this paper, and who was hurt January 20, 1900, and then refused operation. I found a fracture of the tenth and eleventh dorsal vertebræ, in which the cord had been compressed since the time of the accident. The separation of the fragments was very difficult, owing to adhesions and callus, and an unusual amount of hæmorrhage, due no doubt to separating the tightly bound ligaments and fragments; the dura was opened and the cord thoroughly irrigated with hot salt solution. There was no pulsation in cord. The wound was closed tightly with deep and superficial sutures. Patient reacted nicely, his temperature has not been elevated since the operation, and his condition is most excellent. What the ultimate outcome will be it is hard to say; but this case certainly demonstrates the need of early operation, and, had this man consented in the beginning, I firmly believe he would be walking to-day, September 10, 1900.]

TRANSPERITONEAL URETEROLITHOTOMY. REPORT OF A CASE IN WHICH THE STONE WAS LOCATED BY THE X-RAY.

By GEORGE N. J. SOMMER, M.D.,

OF TRENTON, N. J.,

ASSISTANT SURGEON TO ST. FRANCIS'S HOSPITAL.

Miss M. H., aged twenty-three years, white, a timekeeper in a rubber factory, consulted me, April 7, 1900, for severe paroxysmal pain in the abdomen, accompanied by vomiting, for which she had been treated for some time without relief. On the 12th, in response to a summons, I saw her, and found her suffering with severe pain over the right side, both anteriorly and posteriorly in the loin, with transmission of the same pain in the line of the right ureter. On palpation marked tenderness was noted over the right kidney and in the line of the ureter. She complained bitterly of a burning sensation at the external urethral orifice. She was vomiting severely at short intervals a greenish colored mucus, small in amount. The above symptoms lasted with varying degrees of intensity for about forty-eight hours, and were then succeeded by a dull aching in the loin, with slight pain on deep pressure over the kidney. During the attack she voided very little urine, but on its cessation she passed a considerable quantity. The first urine passed after the paroxysm showed the following: Acid in reaction, color pale yellow, specific gravity 1020, and contained about one-tenth by bulk of albumen. Microscopically, a few pus cells, some red blood-corpuscles, many vaginal and vesical epithelial cells, some phosphatic crystals, no uric acid or oxalate of lime crystals.

The family history was negative. No tuberculosis or rheumatism. The patient herself had always been well up to the time of her present illness. The first attack of colic occurred in January, 1899, which confined her to bed for about one week, and was thought to be appendicular in origin.

She had no further attacks until January, 1900, and from that time on she began to have them again and again at short intervals, usually a week between at first, and finally only a few days. During these attacks there was usually a great desire to void urine; but when the pain was severest she could void none until it ceased, when a large quantity would be voided. No blood was noted during any of these attacks.

It was suggested to her that a radiograph of the kidney be taken in order to confirm the diagnosis of renal calculus; and for this purpose she was referred to Dr. Charles L. Leonard, at the University Hospital, Philadelphia, on April 20, 1900. A radiograph of both kidneys and pelvis, so as to include ureters and bladder, was made. "The technique employed for this purpose was that described in Dr. Leonard's paper in the ANNALS OF SURGERY, February, 1900, and consisted essentially in the employment of a self-regulating tube set to run at a one-and-one-half-inch vacuum. The tube was fourteen inches above the plate over the last lumbar vertebra, that is, in the axial line of the pelvis. The exposure was ten minutes." A study of the radiograph showed both kidneys to be free from calculi, but at a level with the brim of the pelvis on the right side in the line of the ureter a calculus was found.

She was admitted to St. Francis's Hospital, May 4, 1900, for removal of the stone, which she earnestly desired, as it was making her life miserable owing to lumbar pain and distress, and she was losing strength and flesh, having lost since January 1, 1900, ten pounds of a mean weight of ninety-six pounds, and was also unfitted from following her usual employment.

On May 5 she was etherized and an attempt made to favor the passage of the stone by dilatating the vesical end of the ureter, but, owing to inexperience, the vesical opening of the ureter was not located. However, the stone could be felt through the roof of the vagina and through the rectum bimanually high up on the postero-lateral wall of the pelvis below the iliac vessels by following up the vesical end of the ureter, until it was found to thicken, and an oblong body was felt which, when attempts were made to fix it, only faded away. Transperitoneal ureterolithotomy was chosen for the attack on the stone, owing to its being the easiest method, and because of the very small amount of pus in the urine, rendering the risks of peritoneal infection very

small. This procedure was carried out under ether anæsthesia, May 8, 1900, at 10.30 A.M., with the assistance of Dr. R. R. Rogers, Jr. An incision eight and one-half centimetres long, slanting inward, was made through the outer edge of the right rectus muscle. On opening the peritoneal cavity and retracting the edges of the wound, the right ureter was at once seen to be dilated to about the size of a lead-pencil. On following the dilated portion downward over the pelvic brim, it was found to end sharply in a hard body at a point one centimetre below the iliac vessels. An incision two and one-half centimetres long was made through the posterior peritoneum over the ureter, and the edges retracted with catch forceps. An incision three-quarters centimetre long was made in the ureter over the hard body after pinching up the ureter between the index-finger and thumb without loosening it from its bed. The stone had by this time slipped up the ureter for about two centimetres, but was easily rolled down and out of the ureteral incision by the fingers of the other hand. A single fine silk Halsted mattress suture was placed on the ureter, through its coats as far as the mucous membrane, and tied so as to invert the edges of the incision. The ureter was then buried behind the peritoneum again, by bringing the edges of the incised peritoneum together with a running suture of fine silk. The peritoneal cavity was irrigated with normal saline solution, and about one-half litre left behind. The abdomen was closed with a tier suture—one of fine catgut—for the peritoneum and muscles, a silver wire Halsted mattress suture for the fascia, and an intracutaneous catgut for the skin. No drainage was employed. The stone weighed 165 milligrammes (two and three-quarters grains), and was triangular in shape, one centimetre long, one centimetre wide at its base. It was very rough on the surface, reddish brown in color, with some whitish spots on its surface, and is probably a mixed uric acid, oxalate calculus.

She reacted well from operation, which lasted about forty-five minutes, her temperature the morning of operation being 99° F.; pulse, 98. Four ounces of urine were withdrawn by catheter and showed the following: Much free blood, acid. Microscopically, many red blood-cells, a few pus corpuscles, and chemically contained one-fourth by bulk of albumen. The next morning, May 9, 1900, there was very little blood present, urine much clearer, showing that the right kidney was probably in

good functionating order. The patient vomited considerably during the first few days, this being probably due to the early administration of Epsom salts. Urine examined May 10 showed the following: Smoky, acid reaction, trace of albumen, many uric and oxalate of lime and triple phosphates, some blood, pus, fine granular casts, bladder and ureteral epithelium. Note made May 16 states that she was having evening rises of temperature, 100.3° F. being the highest. Examination of the wound showed some suppuration in the catgut suture in the superficial fascia, which on evacuation produced an immediate fall of temperature to normal.

On May 30, 1900, there was present but slight amount of discharge of pus from wound, which is healed throughout except a small sinus. Patient is out of bed, appetite good, and expresses herself as feeling like a new woman. Urine examined to-day shows it to be pale in color, faintly acid, no albumen, a few triple phosphate and uric acid crystals, no oxalates, some squamous epithelium, and a few faintly granular and hyaline casts.

June 11, 1900.—Patient discharged from hospital to-day; wound entirely healed.

I am under obligations to Dr. F. L. Wood and Mr. F. X. Liedmayer for painstaking urine analyses.

[NOTE.—October 1, 1900. Patient called this day, perfectly well, and has gained much in strength and weight—about fifteen pounds—since leaving hospital.]

EDITORIAL ARTICLE.

SURGICAL ANALGESIA BY SPINAL COCAINIZATION.

THE most prominent, if not the most important, outcome of the work of the Surgical Section of the Thirteenth International Medical Congress held at Paris this year is the popularity given by Tuffier to the method of producing surgical analgesia by the injection of cocaine into the subarachnoid space in the lumbar region. Originality in this procedure is not claimed by Tuffier, the credit of first employing it being generally given to Bier, of Kiel. It was not until attention was called to the fact that Dr. Leonard Corning, of New York, had not only suggested spinal cocainization, but had actually employed it for surgical purposes, that the credit was likely to be placed where it properly belonged. It is to be deplored that want of familiarity with American scientific literature has led our European brethren in this instance, as upon occasions in the past, to ignore the original work done on this side of the Atlantic, with all the possibilities of acrimonious debate as a result. Certain it is that Corning's name has not been mentioned in connection with this method except by his own countrymen; yet it cannot even be urged in excuse for this that the language in which he described his animal experiments is uncertain, or the journal in which he published both the experiments and the application of the method to the human subject is obscure.

Aside from the question of priority, the most interesting point in regard to the whole matter is the applicability of the method to the work of the every-day surgeon. This at once brings up the question of the possibility of its superseding the

anæsthetic agents now in common use, namely, ether and chloroform. Apart from questions relating to the relative risks run in the use of the two methods, this question must be answered in the negative at the present time. Although a large number of operations may be done in less than an hour, and the operating field below the diaphragm offers a wide area for surgical work, yet there are many most important operations that must take upon an average a longer time than the analgesia from spinal cocainization can be expected to last, some of which are located below the diaphragm, as well as many minor procedures above that point. So that, what with necessarily prolonged operations below the average height of the analgesia, and these as well as shorter operations above this point, there is a wide operative field yet to be covered before the reign of ether and chloroform can be said to come to an end.

The next consideration relates to the risks of the procedure itself. No deaths have yet been definitely reported from trustworthy sources; although it is a well-known fact that such have occurred, and that rather suddenly, where simple lumbar puncture has been made as an aid to diagnosis in obscure spinal and cerebral lesions and neoplasms, particularly the latter. Since no injections were made in these cases, and since, in addition, the symptoms which occur to a more or less extent following cocainization are quite as constantly present in simple puncture, the action of the drug itself must be largely discounted in estimating the risks of the procedure, as it is performed for surgical purposes in subjects presumably healthy as to their spinal and cerebral regions, especially in view of the small amount of the analgesic agent employed. In view of these facts, our attention may be more profitably turned in this connection to the possibilities of inflicting mechanical injury, and to the chances of carrying septic material into the subarachnoid space through errors in the aseptic portion of the technique, as well as to the susceptibility of the spinal and ultimately the cerebral meninges to such infection.

As to mechanical injury, the risks of inflicting such upon important structures is insignificant. In this connection the extra-dorsal structures may be left out of the consideration. Aside from the slight puncture of the meningeal walls of the cavity itself, there is only a remote possibility of the needle piercing the nerve structures, the cauda equina floating loosely about in the cerebrospinal fluid and escaping the needle with a short or blunt bevel, which should always be employed. Even should these nerve structures be invaded, it is highly improbable that serious damage will be inflicted, as much more important nerve structures, and even parts of the central nervous system, have repeatedly been explored in a similar manner, and without the slightest evidence of disturbance resulting.

The question of septic complications following the puncture and injection is of sufficient seriousness to engage the careful consideration of those who avail themselves of the new method, and who by so doing give their sanction to its use at the hands of others. It is manifestly impracticable to restrict its use after it has once found favor among those who are looked upon as authorities in surgical matters, and who, it may well prove to be, are competent to use it with perhaps even less risk than attends ordinary anæsthesia. Yet it would be most unfair and unprogressive not to attempt to determine by actual use its applicability to surgical practice for fear that, should its employment be followed by flattering successes, it might be applied by those in whose hands it would be conducive to harmful results. For, just as in the days when Lawson Tait first published his remarkable (for those days) experiences in abdominal surgery, and there came into existence numberless would-be laparotomists who possessed but little skill and less conscience, so in the present instance there will spring up a host of individuals who will employ the method to its detriment and the discredit of the profession.

But these risks must be taken as in all things new in surgery which require experience in their use in order to learn their risks,

establish their value, define the limits of their application, or determine their worthlessness.

To what extent the spinal meninges are susceptible to the ordinary micro-organisms which are likely to be carried into the canal, and what risks in this respect the patient runs beyond what ordinary surgical preliminary care can provide against, has not yet been determined. It is not to be supposed that the spinal meninges are fool-proof, any more than are the peritoneum or the cavities of joints. While it is true that the man who is fit to do operative surgery at all is fit to practise this procedure, on the other hand it is to be hoped that those who do but little surgery, and that of an emergency character, will realize their shortcomings in respect to the asepsis required for this method of insuring to the patient a painless operation, and employ one or another of the general anæsthetics. The occurrence of suppuration following the infliction of an operation wound is not incompatible with final recovery, even in cases of abdominal section or arthrotomy; but the patient who develops an infective meningitis as the result of a spinal puncture with a dirty needle is absolutely and positively doomed, nor can the surgeon who is responsible for his condition lift his hand to aid him.

While, therefore, it is highly proper that the skilled and careful operator whose daily work is one of aseptic details, the carrying out of which have become second nature to him, should gather experience and knowledge concerning, and help the world to reap the benefit of whatever is of value in the new method, it is only fair that a note of warning should be sounded for the benefit of those who, little realizing what may happen, may, in the absence of such warning, sacrifice human lives and place in jeopardy a discovery that may yet prove to be an almost inestimable boon to humanity.

In all the articles which have appeared upon the subject there has been a noteworthy absence of any attempt to explain the precise manner in which the cocaine acts upon the sensory

nerve structures, save by the indefinite statement that it acts "through the circulation." The observations of Lenandowsky are of interest in this connection, who asserts that the cerebrospinal fluid is a specific product of the brain and partakes of the nature of lymph. He showed by experiments that such agents as strychnine and ferrocyanate of sodium when introduced into the subdural space and mingled with the cerebrospinal fluid passed directly into the nerve substance through its lymph channels and without the intervention of the circulation. Confirmation of these experiments must lead to the inevitable conclusion that the cocaine gains entrance into the nerve substance in the same manner. This will also explain the extreme rapidity with which analgesia is effected in some cases, the extremely small dose required, and the absence of some of the characteristic toxic effects of the drug; for, in spite of what has been said about the headache, nausea, and vomiting, and other symptoms erroneously attributed to the effects of the drug, these are not the symptoms of cocaine poisoning as met with after its use by subcutaneous injection or in the shape of concentrated spray solutions; as has been already pointed out, they follow spinal puncture when no injections are made, or when a simple saline solution is injected. It has developed in the course of the writer's experience with the method that quite as uncomfortable symptoms have followed the use of five minims of a 2 per cent. solution as of thirty minims, and that likewise the amount of cerebrospinal fluid withdrawn bears no relation to the after effects. In upward of forty cases the patient who suffered the least from the after effects lost the most cerebrospinal fluid. In an attempt to determine the least amount that would effect analgesia, it was found that five minims of a 2 per cent. solution were not sufficient to produce analgesia in the popliteal space of a lad of nine; an additional five minims being injected, and then with only indifferent results; while five minims of the same solution mixed with twenty-five minims of a 4 per cent. solution of antipyrin were amply sufficient

for the purposes of an extensive hæmorrhoid operation by the cautery method in a vigorous man. It may be of interest to state in passing that the after effects in this last case were more pronounced than in any of the others. This brings up the question of the use of mixtures of cocaine with such drugs as antipyrin,—mixtures which have been found by dentists to be of value in producing analgesia by cataphoresis, lessening the amount of cocaine required.

It seems to be pretty clearly shown that, in our present state of knowledge concerning the *modus operandi* of the method, it is impossible to determine beforehand either the extent of the analgesia or the length of time that it may be expected to last. In the writer's cases it would seem that, with the present weak solutions and small quantity of the drug employed, these are quite sufficient for those who are susceptible to the influence of the agent, and not enough for those who are insusceptible, affecting these latter over a less area and in a more transient manner. The behavior of the cases suggested that either larger quantities of the drug must be employed or measures taken to effect its distribution over a larger area. It may be that the former proposition will be the first to be entertained, particularly in view of the fact that what has been supposed to be the toxic effects of the drug are not really due to this cause at all.

As to the effects of intraspinal injections upon the cord itself, Nicoletti, of Naples, has shown by animal experiments that no histopathological lesions of the nervous system followed subarachnoid injections. In the writer's cases Dr. William Browning, of Brooklyn, investigated the condition of the patients from the neurological stand-point at various periods of time following the injection, with negative results.

GEORGE RYERSON FOWLER.

INDEX TO SURGICAL PROGRESS.

GENERAL SURGERY.

I. Traumatic Origin of Tumors. By K. WURZ (Tübingen). In an analysis of 714 cases, embracing benign and malign growths, but nineteen could with more or less certainty be traced to an antecedent trauma. If the probable cases would also be considered, the percentage could be placed at five.

Most of the benign growths originated without any causal connection with the trauma. Mechanical insults played a noteworthy *rôle* in osteomas exclusively, of which no less than 40 per cent., in all probability, were traceable in every instance to a severe injury; yet even under these circumstances the underlying cause may have been an osteomyelitis, tubercular or syphilitic, or even an attenuated bacillary infection.

As for malignant growths, sarcoma due to trauma is represented by 7 per cent., whereas carcinoma figures with but 1 per cent., because the insults were never of a severe nature, and at the utmost merely slight external injuries. Therefore, statistically, an isolated traumatism as an etiological factor is only under consideration in osteomas, carcinomas, and sarcomas, and plays a conspicuous *rôle* exclusively in osteomas on the one hand, and sarcomas (of the organs of locomotion) on the other hand. These statistics offer a lower percentage than that of others, for the reason that only cases with a single insult to their credit are treated, and instances of repeated irritation and scar formation are viewed as foreign to the purpose of this statistic.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 3.

II. Report of the Heidelberg Surgical Clinic for the Year 1898. In the Supplement to the twenty-sixth volume of the *Beiträge zur klinische Chirurgie* is contained a report for the year 1898 of the work of the Heidelberg Clinic, and though the statements are summary, yet the following data concerning innovations and mooted points are of decided interest.

Thus, in removal of lingual carcinoma the cautery is employed evidently to insure a more perfect asepsis. Among goitres, in ten instances, infiltration anæsthesia was employed; and it is emphasized that just in those cases where chloroform narcosis proved bad, infiltration anæsthesia was pre-eminently serviceable, and additional security of the intactness of the recurrens nerve could be insured by patient's conversing. It would seem from the oft-repeated reference that the ninth and tenth ribs were chosen in thoracotomy; that the teaching of Schede that even these collections of pus should be opened at most dependent points is receiving due attention. For benign obstructions of the stomach, von Hacker's method with the Murphy button was used to the exclusion of every other method, though in three instances a subsequent recurrence of stenosis at the site of the anastomosis necessitated an enteroplasty (Heinecke-Mickulicz). In malignant obstructions, von Hacker-Murphy was performed twenty-one times, with two deaths, due to no technical dereliction; one death due to marasmus, the other to collapse.

Wölfler's operation performed three times, always with greatest difficulty. Five pylorectomies were done with the button; two deaths, one due to leakage, the other to pneumonia. In contrast to all of this gastric work, the suture was relied on in most of the intestinal resections. It is evidently the practice to search for the appendix and resect it in all perityphlitic abscesses. Of eleven cases thus operated, two died. One having existed six weeks, died of pyæmia, the other six days, died of sepsis. In the herniotomies, Bassini's and Czerny's methods figure equally.

Out of thirty-eight cases operated for biliary disease, but six

died. These embrace in part twenty cholecystostomies with one death, choledochotomy four, cholecystectomy four, cholecystenterostomy without the button five times with two deaths. The remaining cases were exploratory. Among the five tubercular kidneys all were palpably large kidneys, and no cystoscope was used. In a single instance a papillomatous growth was removed with the aid of an operating cystoscope. Beck's operation for hypospadias was performed three times, but failed to remedy the deformity because of retraction of the mucous membrane, which brought the orifice near the under surface of the penis again. Bottini's method for enlarged prostate was very successful in two instances, and in two others a total failure. Among mammary carcinomas a noteworthy occurrence was the stretching of the brachial plexus for the relief of neuralgia in a case operated on six years before; no relief, though, was attained. A liberal use of iodoform injections into various joints was not fraught with any benefit, and in most instances had to be followed by incision for drainage of abscesses or still further extensive procedures.—*Beiträge zur klinische Chirurgie,* Band xxvi, Supplement.

MARTIN W. WARE (New York).

HEAD.

I. Trephining for Tumors of the Brain. By DR. REINHARD HASS (Heidelberg). Hass reports five cases of brain tumor operated upon by Czerny. These, together with two cases previously reported, show a mortality of 56 per cent., agreeing in this respect with the experiences of Chipault and Starr. An accurate diagnosis of tumor to the exclusion of any other intracranial lesion, its location, and its pathological nature are evermore essentials for a successful operation. In but two of the cases was choked disk present. Six times the tumor was located in the motor area, once in the cerebellum. As an index of the extent of the growth, reliance is placed on the relatively scant occurrence

of choked disk associated with growths of the motor area; conversely, a marked choked disk speaks for a large growth. More uncertain than the extent of the growth is its nature. Though but a small percentage of the growths is to be classed as operable, yet the osteoplastic resection of the skull (Wagner) has greatly enlarged the operative possibilities. Technically, Czerny uses the circular saw for the outer table, reserving the chisel merely for the inner table. The base of the bone flap is divided with the Gigli saw.—*Beiträge zur klinische Chirurgie,* Band xxv, Heft 3.

CHEST AND ABDOMEN.

I. Operations for Carcinoma of the Breast. Heidelberg Clinic, 1887-1897. By Dr. Fr. Mahler (Heidelberg). This contribution is intended to afford an insight as to what has been the ultimate gain since asepsis has replaced antisepsis, supplemented by the more radical procedure of removal of portions of the pectoralis major as applied to 161 cases of mammary carcinoma. Eleven cases were passed as inoperable; of the remaining 150, two died in consequence of the operation, ninety-three of recurrences, one living with recurrence, thirty-four living and cured or died of intercurrent disease, and twenty unheard of.

Heidenhain's operation was the extent of the radical procedure, as it seemed of questionable moment whether the prognosis could be materially bettered by a more extensive, in a measure, mutilating operation. In fifty-four cases recurrence was substantiated, of which the time of their appearance is given in thirty-four instances. Ten times after two months, twenty times after seven months, and twenty-five within one year and six months. These fifty-four certain recurrences with seventeen doubtful ones, a total of seventy-one out of 150 cases on the other hand, raise the question of the advisability of a more radical procedure. As a result of the operation, but twenty-eight cases (21 per cent.) lived three years; eighteen times the glands were removed, and in ten instances they were not involved. This 21

per cent. of "*arbitrary three-year limit cures*" is an increase of 3 per cent. as compared with the results of previous years, but may be purely accidental. Author would advance the limit of cure to five years, since two of his cases lived to this time free from recurrence. If—judged by this standard—cases operated on up to 1894 be considered, seventeen cases lived beyond five years (14 per cent.). But this figure even includes a small number, three (5 per cent.), operated a second time. By far the greatest frequency of the recurrences was at the site of the scar, wherefore the author concludes a better result may be offered by more extensive operations at the expense of a possible functional disturbance.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 3.

II. Surgical Treatment of Colitis. By DR. H. LINDNER (Berlin). By the treatment instituted in the two cases herein narrated, it is once more evident that the therapy of medicine tends to accuracy in the degree that it is surgical. The first case concerned a male, twenty-three years of age, afflicted with chronic ulcerative colitis, the ulcers even extending into the rectum. Because of the intense pains and tenesmus and wasting, posterior proctotomy was performed, but without benefit, leaving the patient incontinent. To place the rectum at rest, colostomy (Maydl) was performed at the colon ascendens; but the artificial anus so preyed on the patient's mind that suicidal intent necessitated restitution of the intestinal canal three months later, just at a critical moment, when a longer persistence of the intestinal fistula would have secured the end sought.

The second patient was a female, aged forty-nine years, hysterical in a high degree; multipara. For the relief of prolonged and persisting abdominal pain, the patient had performed on her, at intervals during five years, herniotomy, nephrorrhaphy, vaginal hysterectomy, and a laparotomy for adhesions. Her neurasthenic condition was ascribed by Kutner to malnutrition due

to a chronic colitis with atony. Symptoms: tetesmus, extensive tympany, and defecation so painful as to cause fainting. At the instigation of patient, operation of intestinal exclusion of the ascending transverse and descending colon was performed.

Operation.—Laparotomy at the right margin of the rectus, division of the ileum, closure of its distal segment, and implantation of the proximal segment into a loop of the transverse colon. Then laparotomy at the left margin of the rectus and anastomosis of the transverse colon with the sigmoid flexure. Recovery from this operation was followed within four months by the gratifying result of a gain of thirty pounds in weight. The justification for this operation lay in the fact that this neurasthenic condition was secondary to a hitherto unrecognized colitis. By this extensive exclusion, neither nutrition suffered nor were the stools fluid as a result of their direct passage from the ileum into the colon.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 3.

III. Congenital Duodenal Atresia. By Dr. Max Oscar Wyss (Zurich). The pathological findings constitute the novelty of this case.

History.—An infant three years of age was brought to the clinic for persisting vomiting of meconium-like fluid and no movement per rectum, though a bougie could be introduced fourteen centimetres and some meconium withdrawn. The abdomen was not distended and the diagnosis placed as atresia ilei.

Post-mortem.—The entire extent of the colon was distended with meconium, no changes in the small intestine, stomach apparently hour-glass shape, the dividing line constituting the pylorus, the lower piece being the cul-de-sac of the duodenum, containing meconium. The walls of the sac were thin, of violet-gray color, and muscle fibres absent. The sac is not patent even to extensive hydrostatic pressure, nor are the orifices of the pancreas or bile-ducts present. On the outer aspect appears a strand one and one-half centimetres long, continuous with the ductus choledo-

chus, formed as usual with the confluence of the hepatic and cystic ducts. The interior of this strand is not lined with epithelium. The arteries supplying this segment of the bowel are hypertrophied, in marked contrast to the poorly developed superior mesenteric artery, and the absence of its branch, the pancreatico-duodenalis inferior. This latter finding, together with absence of inflammation or torsion of the bowel, puts it in the foremost rank as a causative factor. This angiogenesis the author regards as a prime factor in many other congenital anomalies.

Diagnosis can only be one of intestinal obstruction, presumptive of its situation in the degree that the meteorism varies after emesis, and as to the quantity of meconium passed and the character of vomitus.

Operation.—As any resection or anastomosis would sacrifice the duodenal papilla, gastro-enterostomy is the only rational procedure.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 3.

MARTIN W. WARE (New York).

BONES AND JOINTS.

I. Tuberculosis of the Bones and Joints of the Foot. By DR. O. HAHN (Breslau). This *résumé* of 704 cases, without offering anything distinctively new, substantiates the hitherto accepted teachings. Tuberculosis of the foot is the same as that of any other tuberculosis in any of the other bones of the body, particularly as to its distribution according to sex, among whom the males figure with 62 per cent., in its preference for the period of puberty, its dependence on heredity, and its relation to occupation and social status of the individual (laboring class). It ensued in 13 per cent. of the cases after a trauma in individuals affected or not with tuberculosis. The lapse of time between trauma and the appearance of the tuberculosis amounted to one or more months. No distinctive feature was indicative of the

early recognition of the transition from post-traumatic effects to tuberculosis.

The site of the tuberculosis diminishes directly in proportion to the distance of the bones and joints from the ankle-joint. The statical bearing of the bones is no factor in determining the localization of the tuberculosis, but, on the contrary, the quantity of cancellous tissue in each bone; hence the following order of frequency, os calcis, astragalus, cuboid scaphoid, etc. Again, the focus in each of these bones is in proportion to the prevalence of the greatest amount of cancellous tissue; and, finally, the same holds good for the situation of the fistulous tract in the bone. The ankle-joint was most frequently invaded, and Chopart's and Lisfranc's next in order; 31 per cent. were primary synovial tuberculosis, and 69 per cent. the focus was osseal. As a conservative treatment, iodoform oil injection proved a sovereign remedy; as partially conservative, the 126 atypical resections may be viewed. The more radical operations comprise resection of the ankle, fifty-three times; exarticulation, Lisfranc, three; according to Chopart, four; subastragaloid, Malgaigne, five; Mikulicz, one. Amputations: Symes twenty-six, Pirogoff forty-one, Von Bruns, tibiocalcaneal resection twenty-six, twenty-nine amputations of the leg and two of the thigh. Of late, all the amputations were performed according to Von Bruns's subperiosteal method.

A large number of these data are of no particular value at this recent day because they date back to pre-antiseptic days, and only serve to emphasize the advancement nowadays. Particularly does this obtain in regard to the large number of amputations performed because of the suppuration supervening after tolerably simple operative procedures.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 2.

MARTIN W. WARE (New York).

RECTUM AND ANUS.

I. **The Treatment of Rectal Carcinoma at the Rostock Clinic.** By Dr. F. Schneider (Rostock). This review of 115 cases treated at Rostock during the period of 1883-1899 purposes in the main to show the gain secured by the sacral methods introduced by Kraske in 1887, and thus to offset the adverse contention of English and French surgeons. Sixty-six males and forty-nine females made up the list of the afflicted, the average age being fifty-nine for the former, fifty-five for the latter. Four cases are recorded during the juvenile period, viz., aged fourteen, fifteen, seventeen, seventeen, and all were examples of cylindrical carcinomata, and their fate that of adults with like carcinomata.

Etiologically, hæmorrhage and prolapse were found responsible factors in the greater number of instances. There were no distinctive rectal signs peculiar to carcinomata, as in most instances digital examination alone cleared up the situation.

Operation.—Whereas Kraske's operation has enlarged the field and scope of operative interference, it has in no measure replaced the older procedures, which are applicable to less extensive carcinomata, and are therefore not competitors with Kraske's method. Concurrent with the latter are Kocher's and Schlange's osteoplastic methods. Against the latter it is held that it offers too small a space, and leaves too many pockets, which favor wound infections. Other procedures, like Rehn's vaginal route or the abdominoperineal route of Quenu and Hartmann, were not practised. The indication set down for Kocher's method is a growth beginning just above the anus, and whose upper limit can still be palpated, no adherence to the sacrum, and a tumor that can be drawn down. Kraske was reserved for growths so extensive as not to permit of the introduction of the finger into the lumen of the bowel in order to palpate the upper limit of the growth, and where extensive adhesions existed with the sacrum. The performance of methods without bone resection is limited to growths situated no higher than eight to ten centimetres, which

must not be circular nor adherent, nor must there be any metastases in the sacral glands. As inoperable are to be regarded cases where the bladder or uterus is invaded, or where infiltrations are extensive or flat, and where there are metastases of the internal organs. Between these two latter extremes lies the medium for bone resection methods, which embrace by far the majority of operations. The restoration of the rectal canal was favored by end-to-end suture of the segments, provided the proximal stump was freely movable, and enough of the anal stump was preserved; and be it here stated, that only in exceptional instances could the peritoneal reflection be spared. To ensure accurate adaptation, supplementary sutures were passed through perirectal tissues. This method was practised in seven out of seventeen cases with success. Where the distal segment was small and the proximal freely movable, invagination of the latter into the former was done: this was executed thirty-one times successfully. Artificial sacral anus was made seven times, and three times according to the torsion method of Gersuny, and only in one instance, according to the latter method, was continence obtained.

A summary of the results is as follows: Cases operated without bone resection twenty, of which thirteen died after one year and ten months; two died as direct result of the operation; three times was continence obtained. Seven survived three years, and of these two even lived beyond nine years. With bone resection according to Kocher's method, twelve cases were operated, four died from complications associated with the operation; of the surviving eight only one lived three and another six years. In no instance was continence obtained. Operated by Kraske's method are seventeen cases; thirteen survived the operation, four died from complications intimately dependent on the operation, seven died after one year; five are living after one year. Kraske's personal experience in the first ten cases offered a mortality of 40 per cent.; later on, with extensive experience in fifty-one cases, this mortality was reduced to 9.8 per cent.

According to Schlange's temporary bone resection four cases were operated on, with no deaths from the operation; only one patient lived three years thereafter. The thirty-two cases of colostomy had an average life of eight months. Twenty-eight cases treated palliatively lived thirteen months.

In conclusion, it is stated that of the thirty-one cases treated with bone resection methods 45 per cent. died in one year, 58 per cent. in two years, and the operation mortality was 23 per cent. Notwithstanding this high death-rate, the author expresses his belief that with the dexterity pursuant to a larger experience these figures can be reduced as Kraske himself has shown, so that the field for the only operative procedure which accomplishes a radical extirpation of the neoplasm can be greatly extended.—*Beiträge zur klinische Chirurgie,* Band xxvi, Heft 2.

II. The Removal of Movable Rectal Carcinoma by Invagination and Ligature. By DR. M. RHEINWALD (Stuttgart). In view of the high mortality of the various sacral methods, averaging 18 per cent. with but 15 per cent. cures to their credit, and only in 15 per cent. of the cases accomplishing absolute continence, Professor Steinthal has conceived a method directed to minimize these advantages.

As movable carcinomas only ought to be radically removed, the growth is made to prolapse by traction upon it. Into the invaginated section of the bowel a corrugated tube is inserted to prevent its slipping, and an elastic ligature applied in healthy areas towards the anal side of the bowel. The growth is then allowed to separate by sloughing. Three times this was performed: in one instance, the prolapsed tumor was excised and sutured. The other two cases were treated typically. In all instances absolute continence was maintained in spite of the necessity to split the sphincter posteriorly in order to bring the growth into view. Of two of the cases it is narrated that no recurrence set in after two and a half and four years respectively. Additional advantages claimed are short narcosis, slight

loss of blood, no danger of disseminating the cancer cells. One decided drawback seems to be the danger of including a loop of bowel which may have slipped into the prolapsed bowel. Heuck, of Heidelberg, narrates a similar method of operating applicable only in exceptional instances. Likewise Trendelenburg advises preliminary laparotomy, division of the mesorectum, and then invagination. With the aid of these modifications, the author bespeaks a more extended application for this invagination method which speedily, bloodlessly, and safely accomplishes a good result(?).—*Beiträge zur klinische Chirurgie,* Band xxv, Heft 3.

MARTIN W. WARE (New York).

REVIEWS OF BOOKS.

SURGICAL ANATOMY: A TREATISE ON HUMAN ANATOMY IN ITS APPLICATION TO THE PRACTICE OF MEDICINE AND SURGERY. By JOHN B. DEAVER, M.D. Vol. ii. Philadelphia: P. Blakiston's Son & Co., 1900.

If one takes up this work with the expectation of finding an exhaustive treatise on anatomy or the results of original research, disappointment will follow. There are few descriptions of aberrant vessels, muscular anomalies, nothing but plain every-day anatomy for the physician and surgeon, so that the title of the work is justified. In no respect does the second volume fall behind its predecessor. The plates, lavishly profuse, are executed in the best manner, and are admirably fitted to teach the subjects which they are designed to illustrate.

There are two ways in which anatomy may be learned, first by rote from written text. This is the old method, most exhausting and unsatisfactory, requiring a pure effort of memory, an act of main strength, something like memorizing a column of the dictionary. Such knowledge is always evanescent, and the student who pursues this course is lucky if he retains his facts long enough to pass the college and State examinations. This is a legacy of the days of body-snatching, when laboratory material was scarce and often obtained only through personal peril. With the establishment of liberal and enlightened laws, however, the great medical schools have been quick to see the faults of the old method, and have appreciated the fact that the only way for the student to grasp and retain the intricate mass of detail in human anatomy is by an acquaintance with the structures themselves.

No engineer ever gained fitness to drive a locomotive by reading and committing to memory pages of description of its machinery, but rather by long experience with the parts themselves, acquired in the round-house and from the fireman's side of the cab. No amount of reading can ever compensate for the knowledge gained by personal contact and observation. To an Esquimaux who had never seen a horse, one glance at the animal would impress its characteristics on the mind where pages of written description would fail. We have taught anatomy in the schools too long in the hardest way and in a fashion opposed to common sense. Quiz compends and quiz masters, crams and crammers; these have been the resources of school and scholar. Happily, the days of the didactic lecture on anatomy are numbered, and men are no longer expected *vi et armis* to memorize pages of Grey. Laboratory teaching and dissection in small classes is rapidly superseding the old fashion. There will always, however, be natural and insuperable limitations to the freest use of this method. Even in the largest cities there will be a chronic scarcity of material. There will be insufficient room in the college, and the lengthened course of four years at most admits of but a few hours a week in the laboratories for a portion of two years. At present a student sees the same part just twice. What familiarity with the locomotive should we expect of the engineer under like circumstances?

It is just here where a book like this work of Dr. Deaver's finds its proper sphere. Its descriptive pages are altogether secondary to the illustrations. These are so clear and of such a size that the student by a careful study of the plates can familiarize himself with the structures under consideration in a manner second only to an actual dissection. Thus, when he begins his first dissection, he will have a clear picture in his mind of what he is to find on the cadaver, and after he has finished his final dissection he has at hand a vivid picture of that which he saw in the dissecting-room. The next best thing to seeing the horse for the

Esquimaux is to see an accurate picture. Description comes afterwards to elucidate and particularize. The value of these plates would have been enhanced if the scale on which each plate is drawn had been indicated. As it is, there is no sort of uniformity, and too often there is quite needless exaggeration of structure, beyond the needs of clearness.

An instance of this needless want of uniformity may be seen in Plates CXCIII and CXCIV, both plates in which the auricle figures. In the first, the auricle measures three inches in length; in the second, five inches and a half. Both plates could have been drawn to the same scale with obvious advantage. The same fault is exhibited in Plate CCXXXIII, where in the upper figure the fourth nerve is depicted as being one-half an inch in its longest diameter, whereas in the lower figure on the same page it is but one-quarter of an inch. The exaggeration in size seems a misfortune, not to speak of the constantly changing scale, of which no indication is given; neither do the requirements of clearness demand even in a schematic drawing such wide variations between similar drawings or from nature. The illustrations of the anatomy of the neck are clear and good. One is a little surprised to find the author stating that it is often advisable in cases of dyspnœa to incise the cricothyroid membrane, the lower operation, if necessary, to be done when the patient has quieted after relief of the dyspnœa. It is difficult to see the reason for making two incisions for a tracheotomy, especially as every surgeon knows that the turgescence of the veins subsides instantly after the trachea is opened. The difficulties of the operation seem to have been a little exaggerated. In speaking of the internal jugular, the subclavian and innominate veins, the author rather naïvely remarks that, if division is necessary, it is best to ligate them before severing them. We fear that the surgeon who neglects this advice will have little occasion to tie them afterwards. The statement is made that the sternomastoid muscle is the guide

to the subclavian artery. We had always supposed that the scalenus anticus was the guide, rather than the sternomastoid.

Plate CLXXXVII is misleading, and calculated to deceive a novice as to the depth at which the subclavian artery is placed. In the figure it is made to appear superficial. Under the subject of the larynx, the author speaks perhaps a little too disparagingly of the operation of laryngectomy, for under improved technique the mortality has decidedly diminished. The organs of special sense are well illustrated, the drawings of the eye being especially fine. One or two points may be mentioned, as, for instance, in Plate CCXXXIV, where the attachment of the four recti muscles is figured as equally distant from the sclerocorneal junction. This is very far from being the case. Commencing with the internus, they are respectively at a distance of five, six, seven, and eight millimetres, their insertions thus being along a spiral line (Motais, Panas). Plate CCXLIV represents the fundus of the eye, but the vessels are both too numerous and much too tortuous. The macula lutea is much exaggerated. In Plate CCLII, which is a view of the auditory ossicles *in situ*, the lower end of the long process of the incus is shown as coming as low down in the tympanic cavity as the lower end of the manubrium mallei. This is a mistake. The plates on the brain follow and are of unequalled clearness, and for teaching purposes have never been excelled. A student, by a careful study of these plates, taking them in series, can gain a better knowledge of the brain than by reading pages of mere description. A description of the male and female perineum closes the volume. The author and publishers are to be congratulated on a worthy achievement. The work will prove of value not only to the student, but to the general practitioner and the surgeon, particularly the man who has been denied the experience of a demonstratorship in the dissecting-room.

ALGERNON T. BRISTOW.

A TREATISE ON APPENDICITIS. By JOHN B. DEAVER, M.D. Second edition, thoroughly revised and considerably enlarged. Philadelphia: P. Blakiston's Son & Co., 1900.

The first edition of this book appeared in 1896, and was reviewed in the ANNALS for August of that year. A revised edition now appears after a lapse of four years, and the reviewer naturally is led to a comparison. At the time of the appearance of the first edition, this Journal felt obliged to call attention to the appropriation in the text, without the use of quotation marks, of certain passages from Talamon, Hawkins, and McBurney. It is with regret that we note that the author has made no change in the passages complained of, and has left out altogether his account of McBurney's description of the intermuscular operation. Indeed, the only reference to this standard procedure is misleading, for the author says that it is appropriate only in cases unassociated with pus. Surgeons who are accustomed to this method of operating will not agree with Dr. Deaver in this statement. Moreover, in the first edition of his book he states that the opening may be made larger by continuing the separation of the fibres of the internal oblique. It is much to be regretted that the full and clear directions given in the first edition for McBurney's intermuscular operation, as well as for the simple incision, have been altogether omitted in the present edition. Hospital surgeons will value this book as a work of reference, and if these were the only men the author desired to reach, minute descriptions of operative technique might well be omitted; but works of this character are of the greatest use more particularly to the occasional operator and the young surgeon, and for them the clear instructions and illustrations of the first edition will be missed. The new chapter on the pathology of appendicitis written by Dr. A. O. J. Kelly is a valuable contribution, and the best article on the subject that has appeared in any of the monographs. The various theories are discussed with temperate and judicial

mind, and the writer is to be congratulated for a very thorough and scientific exposition of the subject. In the chapter on Symptomatology a statement is made which ought to be in the hands of every general practitioner, "a sudden fall of temperature to normal or subnormal by no means warrants a favorable prognosis." More than a few men have been led to a feeling of fancied security by a contrary opinion and lost their patient as a result. This chapter and the one following on Differential Diagnosis show the fruits of ripe experience and sound judgment, and make the book even more valuable to the general practitioner than to the surgeon who is familiar with the various manifestations of the disease. It is perhaps putting the matter a little strongly to say that flexion of the thigh is invariably a symptom of appendicitis. It often happens, particularly when the appendix is in this position, but it is far from being invariably a symptom. Similarly, exception may be taken to the assertion that the pulse bears no relation to the gravity of the disease; for, while it is true that exceptionally one sees cases with a pulse rate below ninety, which are nevertheless dangerous and require immediate operation, it is equally true that the cases in which the pulse exceeds one hundred are uniformly threatening and dangerous in proportion to the elevation of the pulse above this mark. As a matter of fact, however, the man who places implicit reliance on any one symptom will often be at fault, and this Dr. Deaver makes sufficiently clear. All surgeons will not agree with the author in his views regarding the propriety of removing the appendix in suppurative cases, even though it form part of the limiting wall of the abscess. He says that this can be done in skilful hands with comparative safety. Comparative to what? To the danger of leaving it? As far as the immediate prospects of the patient are concerned, there is not only no danger in leaving it, but greater safety, as the author's use of the word comparative implies. Now, with reference to the danger of future recurrence, the author's own statistics on a basis of 4500 cases

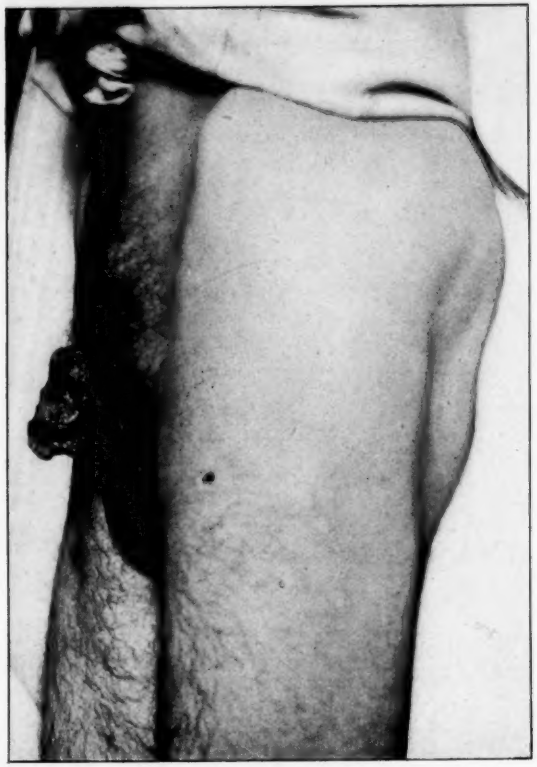


FIG. 1.—Extensive cancer of penis and scrotum.



FIG. 2.—Condition eight months after operation.

show that the patient has eighty chances out of a hundred of escaping recurrence. Moreover, it must be shown that it is safer to pursue the search for the appendix in the presence of more or less virulent pus amidst much broken-down tissue, even with the protection of ample gauze barriers, than to go for the same appendix a week or two later when the wound has become relatively clean, the sloughs discharged, and protective granulations formed. Such a wound is easily disinfected, which is not the case with the original abscess cavity. The author is very properly cautious when he advises the occasional operator to be content with evacuating the pus. Many surgeons of wide experience will be equally cautious in their attempts to remove an appendix under such circumstances. Differences of opinion, of course, will always occur, due largely to the personal equation and the point of view. No one, however, can read this book, whether to agree or disagree, without profit.

ALGERNON T. BRISTOW.

SURGERY: ITS THEORY AND PRACTICE. By WILLIAM JOHNSON WALSHAM, F.R.C.S., M.B. With 483 Illustrations and 16 Skiagram Plates. Seventh edition. Philadelphia: P. Blakiston's Son & Co., 1900.

Walsham's seventh edition on "Theory and Practice of Surgery" may be considered as a good example of the numerous compends intended particularly for a hasty, general review of the entire field of surgery. The subject-matter has necessarily been greatly condensed, and brevity in several instances is too pronounced a feature; but the author has nevertheless succeeded in presenting the cardinal principles of general surgery in an interesting and instructive manner.

The entire book has been revised and matters obsolete have for the most part been omitted.

The first two sections are given to pathological considerations of surgical injuries and diseases, and include descriptions of tuber-

culosis, syphilis, tumors, and diseases which are the result of infective processes in wounds.

The third and fourth sections comprise injuries and diseases of special tissues, and here the general considerations of fractures and dislocations are presented.

In section five, which is devoted to injuries of regions, special fractures and dislocations receive careful attention, and these chapters represent one of the most notable features of the book. Some very clear skiagrams serve to illustrate the various deformities and most common sites of fracture.

Section six includes the diseases of regions, and here the chapters on diseases of the brain, abdomen, and genito-urinary organs are the most noteworthy. In these the surgical teachings represent, with few exceptions, the most generally accepted methods of diagnosis and treatment of the present time.

The chapters on diseases of the eye and ear have been contributed by men of special aptitude in these branches.

WALTER A. SHERWOOD.

ON NEUROMA AND NEUROFIBROMATOSIS. By ALEXIS THOMSON, M.D., F.R.C.S.E. Quarto, x, 168 pp., with twenty Plates. Edinburgh: Turnbull & Spears.

The author of this work has undoubtedly had an extensive experience in a branch of neural surgery which, to the average surgeon of the present time, is comparatively rare. He treats of the neuromata as true and false varieties.

Of the neuroma vera, which is by far the more uncommon variety, he gives a description of the few cases which have been recorded, and limits this form to those tumors in which newly formed nerve tissue is the essential element. They may be circumscribed or diffuse, and their location is most commonly in some portion of the sympathetic system. The diagnosis is always attended with difficulty, and their removal can be advised only when causing an unsightly deformity or when interfering with the functions of adjacent structures.

In his classification of the false neuromata, the author recognizes and describes the following types:

I. Circumscribed; II. Diffuse (generalized Neurofibromatosis); III. Traumatic or Stump Neuromata.

In each of these fibrous connective tissue enters chiefly into their structure.

The chain of clinical symptoms is particularly interesting.

A close relationship between pigmented mole of the skin, elephantiasis nervarum, and sarcoma of nerve origin is demonstrated, and hence the importance of early radical measures in a suspicious case.

The operative treatment of the benign growths yields very good results, especially in the circumscribed tumor. The amount of after-disturbance to the nerve function is surprisingly small.

The stump neuromata, which since the days of aseptic surgery is much more rare than formerly, is regarded as pathological only when causing pain or interfering with function. It seldom attains great size, and otherwise may be regarded in a similar light to bony callus following fracture.

This book is a valuable contribution to surgical literature. It is written in a clear, pleasing style, and its pages are interspersed with numerous good plates and the histories of many illustrative cases which have been under the author's personal observation.

WALTER A. SHERWOOD.

CORRESPONDENCE.

THE TECHNIQUE OF PROSTATECTOMY.

To the Editor of the ANNALS OF SURGERY.

SIR,—The October number of your Journal contains an article by Dr. Herman Mynter on the Technique of Prostatectomy, in the course of which (on page 552) may be found this statement: "Dr. A. B. Johnson has recommended, as a modification of Syms's method, the making of a small incision above the pubes, but without opening the bladder or the peritoneum, and with a finger introduced through this incision the crowding of the prostate downward. He did this successfully in a small man." A foot-note refers to the ANNALS OF SURGERY, June, 1900.

In some way this suggestion of Dr. Johnson did not meet my eye, but I have found the incision of so much value in several cases that I deem the following bit of history worth relating:

On December 5, 1898, I operated, at the St. Louis Mullanphy Hospital, on Mr. A. B., aged sixty-four years, doing a perineal prostatectomy. The patient had been drained by a suprapubic fistula for eighteen months without relief of his most distressing symptoms,—dysuria, pyuria, frequency, and some tenesmus. The lower abdominal wall was extensively sclerosed, stiffened, and thickened about the fistulous track, rendering it probable that an attempt to reopen the bladder by this route would result in opening the peritoneum. An aortic stenosis rendered an anæsthetic hazardous, and necessitated economy in time. The perineal distance (Watson) was too great to enable me to reach the vesical outlet from this route; nevertheless, I attempted a perineal operation, and easily accomplished it by making a two-inch incision in the abdominal wall without opening either the

peritoneum or bladder (the fistula was quite small, admitting only a fine probe and of no service), through which two fingers were introduced to crowd the prostate downward and within easy reach from the perineum. I was surprised and gratified to observe the ease with which the gland could be depressed and brought near the perineal incision when the resistance of the abdominal wall was eliminated by the incision into the supravesical space and the bladder emptied. The hospital record shows that the incisions and excochleation of the entire prostatic mass were accomplished in fourteen minutes. The patient made a satisfactory recovery, the fistula at once ceasing to leak, and permanently closing in a few days.

This patient was presented before the Medical Society of the City Hospital Alumni on January 19, 1899, and the account of the case may be seen on page 3 of the Transactions of the Society for that year. Under the heading, "Report of a Case of Prostatectomy, with Remarks on a Novel Procedure for Facilitating the Operation," the case is published in the *Medical Review,* St. Louis, Vol. xxxix, No. 13, April 1, 1899.

I believed then, as may be seen by my published remarks before the Society, and believe now, that this was the first instance where an extravesical, extraperitoneal, suprapubic incision was done as an aid to perineal prostatectomy.

Since December, 1898, I have found this incision to be of the greatest service in eight cases of perineal prostatectomy, viz., S. D. C., June 5; J. M., June 17; W. B. J., July 10; J. F., September 6; M. D., October 28, all in 1899, and B. M. M., January 18; W. H. M., January 20, and G. C. C., February 11, in 1900.

It is doubtless the experience of every one doing perineal prostatectomy, by which is meant complete or almost complete evisceration of the prostatic capsule, that no such incision or other aid is necessary in every case, even in all those patients who are fat and have protuberant abdomens and long perineal distances. Fully relaxed by complete anæsthesia, many of these

unpromising cases yield sufficiently to suprapubic pressure made by an assistant to enable one to shell out the overgrowths without much difficulty, and especially if the enucleation begins at the apex of the gland, for it is the glandular enlargement which elevates the vesical outlet and presses it beyond the reach of the finger. We are aware of the fact that the hypertrophied tissue is in a state of tension, and the releasing of this intracapsular tension permits the upper part of the growth to descend, even of its own accord, and much more to yield to supravesical pressure. These considerations have for more than two years past influenced me to defer the incision in the abdominal wall until it was apparent that it was necessary. This was usually found to be when an intravesical projection of the median portion required enucleation.

The shortening in duration of the time required in operating (in several instances to ten minutes); the lessening of the hæmorrhage by enucleation from below, and non-interference with the bladder wall; the reduction of the time of convalescence, especially the getting of these old men out of bed soon after operation, even though the perineal incision had not closed, as well as the minimizing of the dangers of septic thrombosis of the veins of the plexus of Santorini, have all led to a decided preference for perineal prostatectomy, and thus to a greatly reduced mortality. The danger of septic thrombosis of the vesicoprostatic plexus of veins has influenced me to attack the growths from the urethral rather than the capsular side of the overgrowth.

Of the objections that may be noted, a partial incontinence to the extent of slight dribbling when the bladder is filled, and due probably to the interference with the prostatic and urethral sphincters, but much more to the anterior fibres of the levator-ani muscle,—the levator prostatæ,—still requires elimination in order to make this the ideal operation.

JOHN P. BRYSON.

ST. LOUIS, MO.

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ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

LEWIS STEPHEN PILCHER, M.D., LL.D.,
OF NEW YORK.

WITH THE COLLABORATION OF

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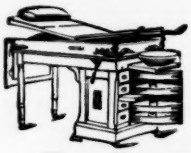
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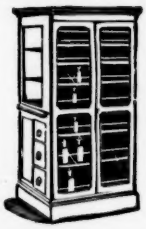
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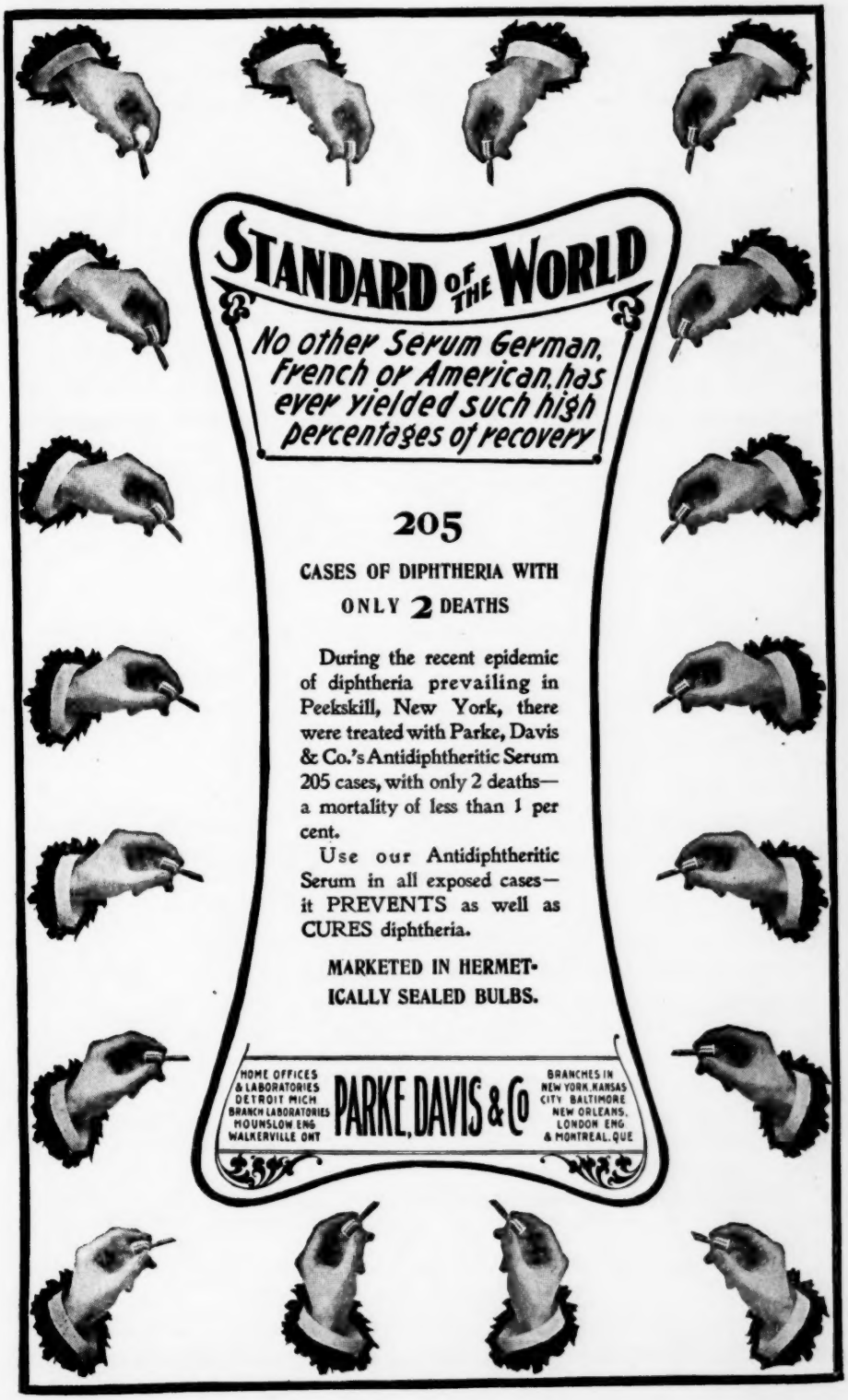
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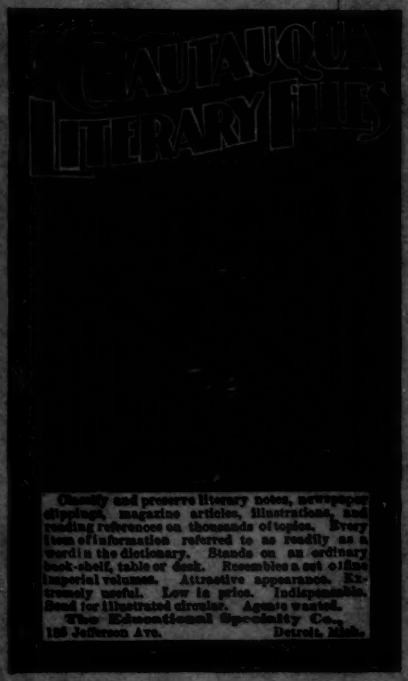
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